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THESIS

ACQUISITION STREAMLINING:
A VIABLE METHOD FOR
ACCELERATED PROCUREMENT OF THE
ADVANCED AMPHIBIOUS ASSAULT VEHICLE

by

James W. Clark, Jr.

December 1993

Thesis Advisor: Richard Doyle

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Acquisition streamlining is enjoying increased attention since procurement of weapon systems has become more complex and lengthy from identification of a Mission Need Statement (MNS) to deployment of the system. Streamlining is required by directives governing the acquisition process for the Department of Defense, yet procurement remains quite cumbersome in execution. This thesis goes beyond streamlining the acquisition cycle and provides methods of accelerating the procurement process within current laws and directives. Using the Marine Corps' Advanced Amphibious Assault Vehicle Program as an example, the researcher discovered that strategies exist which can specifically be tailored to accelerate procurement of the AAAV without adding prohibitive program risk. To implement these methods tailoring of the acquisition cycle to specifically fit the unique characteristics of the AAAV is required. While there is no prohibition against tailoring the acquisition cycle to specific programs, the Department of Defense tends to be very risk averse with respect to acquisition of weapon systems. The AAAV represents a weapon system that is uniquely poised for acceleration of the acquisition cycle through tailoring. Recognition by DOD that there is a legitimate need for accelerating procurement of the AAAV, and that program risk will not increase because of acceleration must occur prior to utilizing the recommendations of this study.

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Acquisition Streamlining:
A Viable Method for Accelerated Procurement
of the Advanced Amphibious Assault Vehicle

by

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Submitted in partial fulfillment
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I. INTRODUCTION

A. GENERAL

As defined by the current roles and missions statement, the United States Marine Corps is tasked with the capability of conducting amphibious assaults against enemy-held shorelines. The Marine Corps is also responsible for the development of "those phases of amphibious operations which pertain to the tactics, technique, and equipment employed by landing forces." [Ref. 1:pp. 117-119] Since World War II, surface-borne amphibious assaults have been carried out using tracked landing vehicles capable of transporting embarked Marines from Navy ships to defended beaches. From the advent of the first amphibian tractor or "amtrack," the vehicle's design has steadily evolved to incorporate newer technologies, to match the changing security conditions or to meet new tactical requirements.

The current version of the Marine Corps' amphibious assault vehicle is known as the AAV7A1 family of vehicles. The "family" of variants is composed of personnel, communications and retriever versions of the basic design. [Ref. 2:p. 1] The AAV7A1 was introduced to the Marine Corps in 1972 as the AAV7. In 1983, a service life extension program (SLEP) was initiated which, by 1986, converted AAV7s into AAV7A1s. The AAV7A1 was intended to serve as the Marine Corps' vehicle for conducting amphibious assaults until the year 2004. [Ref. 18:p. 41]

However, significant deficiencies have been identified with the AAV7A1 over the past few years, and coupled with the age of the system, these deficiencies have warranted the search for a follow-on system to conduct amphibious assaults. [Ref. 3:pp. 1-6] In addition to the identified weaknesses of the AAV7A1, the Navy and Marine Corps have also developed new tactical requirements for Naval Expeditionary Forces which further contribute to the obsolescence of the existing amphibious assault vehicle. [Ref. 4:pp. 1-6] These new tactical requirements developed by the Navy and Marine Corps form a concept for future expected amphibious operations identified as *Advanced* Amphibious Assault (AAA). [Ref. 5: pp. 1-4] This concept will be defined in detail in Chapter II of this study.

The Marine Corps has determined, from an original field of thirteen candidates, that a new vehicle is the solution to advancing current amphibious capabilities. This system is known as the Advanced Amphibious Assault Vehicle (AAAV). [Ref. 6:pp. 5-9] The strategy which will be used to acquire the system will be development and procurement of a new AAAV. [Ref. 22] The Marine Corps is now wrestling with ways to streamline the acquisition process so that the vehicle can be fielded sooner than the current projection of 2009.

Accelerating the acquisition process, the major focus of this study, is critical to the Marine Corps due to the increasing age of the AAV7A1 family of vehicles and because the existing vehicle will not adequately perform the new tactical requirements of *advanced* amphibious assault. [Ref. 6:p. 5] Another issue being studied is the role prototyping plays in the acquisition method to be used for procurement of the AAAV, and how that would affect acceleration of the acquisition process.

B. OBJECTIVES OF RESEARCH

The objectives of this study are to: (1) identify the concept of advanced amphibious assault and its manifestation by the Advanced Amphibious Assault Vehicle, (2) identify viable methods of, and risks associated with, accelerating the acquisition process for procurement of the Advanced Amphibious Assault Vehicle, and (3) recommend a viable, accelerated, acquisition strategy for procuring an AAAV for the United States Marine Corps.

C. RESEARCH QUESTIONS

The following major research question was posed to support this study: What are the viable methods and associated risks of accelerating the procurement process for the Advanced Amphibious Assault Vehicle (AAAV)?

To aid in answering this question, the following subsidiary questions were addressed:

1. What is the concept of AAA as it relates to the current roles and missions of the United States Marine Corps and how is it manifested by the Advanced Amphibious Assault Vehicle?

2. What are the critical criteria against which the methods of accelerating acquisition should be evaluated?

3. What types of risks are associated with each acceleration method that has been presented?

4. What is the recommended strategy for procurement of a new Advanced Amphibious Assault Vehicle for the United States Marine Corps?

D. RESEARCH METHODOLOGY

The information presented in this study was obtained from (1) current procurement literature, (2) documentation obtained from the AAA Program Office, and (3) interviews with acquisition professionals involved in acquisition streamlining activities from Government and industry. Literature references were collected from material held at the Naval Postgraduate School, the Defense Logistics Studies Information Exchange (DLSIE), and Department of Defense (DOD) Directives and Instruction with applications to this effort. Interviews were conducted by telephone and in person and are identified in the list of references.

E. SCOPE OF STUDY

This study is in the form of a case study. Its scope is to ascertain the viability of accelerating the acquisition efforts for procurement of the AAAV. This study addresses methods of acceleration and evaluates their potential effectiveness with regard to the AAAV program. The evaluation of acceleration strategies has been accomplished by review of their effect on other programs to determine if the lessons learned from them can be applied to the AAAV program.

F. LIMITATIONS

This study will address only those methods of accelerating the acquisition process that are considered viable for use with the Marine Corps AAAV procurement. Those methods will then be analyzed for the associated risks they may hold for the future of the AAAV procurement.

G. ASSUMPTIONS

It is assumed that readers of this study will have an understanding of the basic concepts and regulations applicable to systems acquisition.

H. ABBREVIATIONS

A list of acronyms used in this study, and their meanings, is provided in Appendix A.

I. ORGANIZATION OF THIS STUDY

Chapter II of this study examines the conceptual development of amphibious assault and how the Marine Corps procured equipment to support those operations. Chapter III details what the concept of *advanced* amphibious assault is and how it is manifested by the AAAV. Additionally, how the AAAV and advanced amphibious assault fit into the "military technical revolution"[1] will be addressed. Chapter IV will present a brief overview of the Defense Acquisition Cycle and provide distinction between some traditional methods of quickening the acquisition process. Also, Chapter IV will present selected methods of accelerating acquisition and how they could shorten the overall procurement cycle for the AAAV. Chapter V will establish the critical evaluation criteria for each acceleration method presented in Chapter IV and then evaluate their effectiveness in relation to procurement of the AAAV. Chapter VI will conclude this study and will recommend a strategy for procurement of the AAAV.

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[1] Mazarr, M. J., Shaffer, J., and Ederington, B., The Military Technical Revolution, Center for Strategic and International Studies, Washington, D. C., March 1993.

II. AMPHIBIOUS ASSAULT

A. INTRODUCTION

This chapter will cover the background of amphibious assault doctrine and the development of equipment necessary to prosecute that capability. Before the Marine Corps chose to pursue amphibious operations, the Army and Marine Corps were very similar in mission. After this decision, the Marine Corps alone developed the doctrine, and later the equipment to carry out this mission. This chapter details the Marine Corps' involvement with amphibious assault, and the subsequent development of vehicles to execute this mission.

B. AMPHIBIOUS ASSAULT

The primary mission of the Marine Corps is to acquire and maintain a capability to conduct amphibious assault operations. This has been a formal requirement since the National Security Act of 1947. However, the Marine Corps had been focused on offensive amphibious operations long before the Congressional mandate.

1. Background

An amphibious assault is an assault against opposition having organized the beaches and those approaches to the shoreline for defense. The concept of amphibious assault in warfare is relatively new to the world. Lieutenant General

Victor H. Krulak, in First To Fight, contends that the first serious thought given to this type of warfare was addressed in the 1838 book, Precis de l'Art de la Guerre by Antoine H. Jomini. However, the concept of amphibious assault against organized resistance was largely ignored until the British assault of Gallipoli in 1915. After the disaster at Gallipoli the amphibious assault seemed doomed to consideration as an infeasible tactic. In fact, B. H. Liddell Hart wrote that because so many advantages resided with the defender, an amphibious assault was, "difficult, indeed almost impossible." [Ref. 7:pp. 71-72]

Just prior to World War I the Department of the Navy had developed a contingency plan (War Plan ORANGE) for war in the Pacific Ocean with Japan. By 1920, after some revision a key element of the contingency plan was recognition that the Japanese would use island territories and an increasingly powerful Navy to challenge the United States in the Pacific Region. The Navy planners realized under such a contingency as "ORANGE," seizure of the Japanese islands and territories would be required in order to defeat Japan. [Ref. 8: pp. 5-7]

Based on this scenario, the Chief of Naval Operations informed the Commandant of the Marine Corps that the primary emphasis of Navy planning would be for war with Japan. The Marine Corps was advised to develop a structure to prosecute that war, especially focusing on the seizure of advanced naval bases. However, it was not until Major General John A.

Lejeune became Commandant a few months later that the senior leadership of the Marine Corps was ready to embrace the concept of amphibious operations. [Ref. 8: pp. 6-8]

General Lejeune had a unique understanding of the needs of the Navy should war with Japan occur. He saw the vital importance of advanced bases for logistical purposes in preparation for facing the ever-reaching Japanese empire. Lejeune realized that should war with Japan take place, American forces would be required to seize and hold their logistics bases. This effort would require the attacker to defeat an entrenched enemy through means of amphibious assault. [Ref. 7:p. 74]

With a requirement identified and growing interest within the Marine Corps the foundation was laid to begin development of an amphibious assault doctrine.

2. Development of a New Type of Warfare

In order to arrive at a capability of seizing advanced naval bases, as called for in "War Plan ORANGE," the Marine Corps had to go through many phases of development. The first of these phases would be to conceive a strategy of how the Marine Corps' role would fit into a Pacific Ocean war with Japan.

Defining the Marine role in "War Plan ORANGE" would be the primary mission for Major Earl H. Ellis upon his assignment to the Division of Operations and Training section at Marine Corps Headquarters. Ever since his attendance at the Naval War College in 1912 Ellis had long believed that Japan would eventually initiate war with the United States, necessitating a long and difficult series of Pacific island battles to win back advanced logistics bases. The result from Major Ellis was a study titled Advanced Base Operations in Micronesia. [Ref. 8:p. 9] His study, completed in 1921, outlined a step-by-step westward drive across the Pacific, based on projected needs to support Fleet operations. This effort became the framework for American strategy for war with Japan in the 1924 revision of War Plan ORANGE and the Pacific campaign in World War II. [Ref. 8:pp. 7-10]

Once an amphibious strategy had been developed to support Naval operations against Japan, the Marine Corps needed to plan for actual conduct of operations. Many of the problems were foreseen by Ellis in his study. He identified tactical and technical issues to be resolved, as well as the potential man-made barriers and natural coral reefs which would further complicate this new type of operation for Marines. Additionally, he addressed the need for tight coordination in naval gunfire and air support; the need to organize landing beaches for logistics, and a host of other details which would have to be addressed prior to actually conducting amphibious assaults. [Ref. 7:pp. 76-79] Before any of these problems could be solved, Ellis met an untimely death on May 12, 1923 while on a secret reconnaissance mission to the Caroline Islands. [Ref. 8:p. 10]

This "theoretical framework" proposed by Major Ellis then began development and limited testing under other Marine officers during the early 1920s. Two Marines particularly influential to the development of Ellis's theories were Colonels Dion Williams and Eli Cole. Williams began a program of educating the Marines under his command in amphibious warfare. In addition, he conducted exercises in which his troops practiced amphibious landings on the Potomac River. Colonel Cole began an intensive study of the Gallipoli campaign and the reasons for its failure. He also lectured officers on amphibious operations, resulting primarily from his research of Gallipoli. [Ref. 7:p. 79]

Both officers participated prominently in the Fleet Exercises held in the early 1920s. Colonel Williams commanded 1600 Marines in the defense at Culebra in the West Indies in 1924. Approximately 1800 Marines under the command of Colonel Cole made amphibious landings against the defensive force on Culebra. [Ref. 7:pp. 77-80] This exercise was considered to be an extremely large undertaking for a country during peacetime.

Perhaps due to the scope of this effort, the novelty of the tactics, or both, there were numerous problems with the trial amphibious operations. Many of the problems were rooted in coordination of efforts between the Navy and Marine Corps.

Some boats were landed in the wrong locations, others at the wrong time or out of order. Naval personnel were poorly trained for such an operation or not knowledgeable of requirements for amphibious operations. Naval gunfire and air support were either inadequate or misdirected. There were also problems with the boats used to land the Marines during the operation. [Ref. 7:p. 80] The landing craft were not only in short supply but provided virtually no protection to the landing force for the trip from ship to shore. Additionally, members of the landing force were further endangered by having to leap over the sides of the boats at the edge of the beach.

The most beneficial outcome of these exercises was the realization by the Marine Corps leadership that amphibious operations would require considerably more development both in tactics and equipment to be successful. Any progress in finetuning amphibious operations virtually ceased in 1926 due to the heavy commitments on the Marine Corps in Haiti, China and Nicaragua. [Ref. 8:p. 11]

In 1933, serious development of amphibious operations by the Marine Corps resumed. The revival of interest in amphibious assault at this point was more rooted in concern with survival of the Marine Corps as an institution than any other reason. The current Army Chief of Staff, General Douglas MacArthur, had recommended to the President and members of Congress that the preponderance of the Marine

Corps, both personnel and equipment, be transferred to the Army. MacArthur's reasoning was that most of the functions performed by the Marines were identical to the Army, so the Marine Corps was a drain on Army funding. The current Commandant of the Marine Corps was concerned enough with the power of General MacArthur that he assigned General Russell, the Assistant Commandant, the task of developing an amphibious mission for Marines. [Ref. 7:p. 80]

General Russell had been a proponent of amphibious operations for the Marine Corps since 1910, when he stated that when the fleet was operating from permanent bases it should bring with it, "sufficient force and material for seizing and defending" advanced bases in the theater of operations. [Ref. 7:p. 75] He was able to convince the Navy General Board to officially state that the primary function of the Marine Corps should be "the seizure and defense of advanced bases." [Ref. 8:p. 12] Next, Russell convinced the Commandant that a formalized amphibious doctrine needed to be written, not only to specify how amphibious operations would be executed, but to demonstrate this was a unique and desirable capability offered by no other military organization.

The amphibious doctrine which would guide the Marine Corps through World War II, and to a large extent to this day, began at Quantico officer's school during the 1933-34 academic year. Detailing this doctrine was considered so important that, instead of convening normal classes, officer students and instructors combined their efforts to produce an amphibious doctrine addressing tactics, equipment and many other issues only conceptualized by Major Ellis. In June of 1934 a very detailed (127,000 words) "Tentative Manual for Landing Operations" was completed. With some minor changes, this manual was officially published by the Navy in 1938 as "Landing Operations Doctrine, U. S. Navy." [Ref. 8:pp. 11-13]

Beginning in 1935 the Marine Corps began testing the amphibious doctrine prescribed in the just-completed landing operations manual. These exercises took place every year through 1941. Not only were tests of the new doctrine conducted, but crucial amphibious training was provided to both Navy and Marine Corps personnel. These Fleet Landing Exercises, combining elements of the Fleet Marine Force with a Naval Task Force, served to hone the skills and cooperation between the Navy and Marine Corps in conducting amphibious assault operations. The exercises refined the previously identified problems of Naval gunfire, air support and combat loading. They also highlighted the major deficiencies of the Marine Corps in terms of amphibious assault, including too few and inadequate landing craft. [Ref. 8:p. 11-13]

C. EQUIPPING MARINES FOR AMPHIBIOUS ASSAULTS

Now that the Marine Corps had developed a new and unique mission for their role in America's capability to conduct warfare, equipment needed to be procured to support that effort. The equipment necessary for amphibious assaults was a type of vehicle or boat that could transport Marines and their equipment from Navy ships off of the shore, through the surf zone, and disembark them at the area of assault. During World War II, the proving ground for Marine amphibious assaults, two pieces of equipment were used to conduct these operations. They were the Landing Craft, Vehicle and Personnel (LCVP) also known as the Higgins Boat, and the Landing Vehicle, Tracked (LVT) Amphibian Tractor or Amtrac.

1. The Higgins Boat

The origins of the LCVP are rooted in prohibition. Andrew Higgins designed a shallow draft thirty-six foot boat in 1924 for use by rum-runners in the Mississippi Delta during the years of prohibition. This boat, called the "Eureka," was well-suited for beach landings because of its uniquely designed underwater hull. This design protected the propeller from hitting bottom in shallow water and also enhanced the craft's ability to retract itself from the beach after delivering its cargo. [Ref. 7:p. 92]

The Marine Corps first became aware of the Eureka in 1934, although Higgins had been attempting to interest the Navy in purchasing the craft since 1926. The Marines were very impressed with the capabilities of the Eureka and finally convinced the Navy's Bureau of Construction and Repair to buy one of the boats in 1937. In 1939 the Higgins Boat was tested along with three boats designed and constructed by the Navy's Bureau of Ships. The 1939 test reached no conclusions, but allowed the Eureka to remain in the qualified pool of competitors. [Ref. 7:p. 94]

By March of 1941 the threat of war was becoming more and more obvious. With this in mind, the Marine Corps asked Andrew Higgins to redesign his Eureka boat to include a bow ramp for landing small vehicles. Higgins was also asked to design a similar craft that would be capable of transporting an eighteen-ton tank. Higgins quickly transformed both requests to working, full-scale prototypes and by April of 1941 five of these craft were undergoing testing and evaluation by the Navy and Marine Corps. After the evaluation, the Navy approved and ordered two hundred of the Higgins Boats for use in amphibious operations. [Ref. 7:p. 95]

2. The Amphibian Tractor

Although the Higgins Boat provided the Marine Corps with a capability previously unavailable for use in conducting amphibious operations, it could not solve all of the problems that would face Marines in their drive across the Pacific. The first problem unable to be resolved by the Higgins Boat were the coral reefs which surrounded most of the islands to be assaulted in the Pacific Ocean. The Higgins Boat was unacceptable when a coral reef was present because the water was usually too shallow over the coral for a boat to negotiate without ripping out its bottom. The second deficiency constraining sole use of the Higgins Boat for amphibious operations was the need to move supplies rapidly through the beach area to avoid congestion of equipment and supplies there. Congestion at the landing area was one of several problems observed by the Marines who had studied the amphibious assault of Gallipoli during World War I. [Ref. 7:p. 100]

The solution to these two problems for amphibious operations came to be known as the Landing Vehicle Tracked-1 (LVT-1), or amphibian tractor. Although conceptualized by the inventor as early as 1933, the Marine Corps did not become aware of its existence until the October 4, 1937 issue of Life magazine which highlighted this new machine. [Ref. 8: p. 32]

The genesis of the amphibian tractor was born out of disaster. In 1928 a tremendous hurricane devastated many of the towns surrounding Lake Okeechobee, Florida. John Roebling, a wealthy industrialist and financier with a winter retreat in Florida, became very interested in the disaster and the toll it had taken on the area. Many of the workers from his Florida estate who had assisted in rescue operations for the hurricane victims stated if a vehicle or boat had existed which was as equally capable on land, mud and deep water, many lives could have been saved during the rescue. [Ref. 8:p. 24]

In 1932 John Roebling made a pact with his son Donald, who by now owned the Roebling Construction Company in Clearwater, Florida, to design a vehicle that "would bridge the gap between where a boat grounded and a car flooded out." [Ref. 9:p. 54]

The elder Roebling agreed to pay for all design, development and production costs associated with the project. John Roebling was motivated to invest in the amphibious vehicle project for several reasons. The tragic events of the 1928 hurricane certainly influenced Roebling as a humanitarian, but he could also foresee potential lucrative markets for a land- and water-capable rescue vehicle. Lastly, John Roebling wanted to interest his mechanically talented son in some productive venture. [Ref. 8:pp. 24-25]

In January of 1933, Donald Roebling hired a technical staff and began work on the amphibious vehicle project. Roebling and his staff identified the two major obstacles to making the vehicle a reality: weight, and propulsion systems for land and water use. The vehicle had to be light enough for safe buoyancy in water, while sturdy enough for rugged terrain employment. The propulsion systems had to be simple enough so they did not require so much area within the vehicle as to make it useless. [Ref. 8:p. 25]

Roebling answered both issues with innovative ideas. To meet both requirements for weight, he decided to use a relatively new metal called aluminum since it was lighter than steel but would supply adequate strength for land use. Propulsion of the vehicle on land and in water would be accomplished by one system. Roebling took a track system from a commercial crawler type tractor and attached cleats that would perform much like paddles when the vehicle was operating in the water. [Ref. 8:p. 25]

After experiencing numerous problems working with aluminum and attempting to perfect the track, Roebling produced his first amphibious prototype in 1935. The vehicle, which was dubbed, "alligator," was capable of 25 miles per hour on land and 2.3 miles per hour in the water. The first alligator was not very reliable in that after just a few miles of travel on land the tracks would break apart. Roebling was undeterred and tried without success to interest the Red Cross and the Coast Guard in his invention. [Ref. 8:pp. 26-27]

Accepting that his first model amphibian could be improved, Roebling and his team dismantled their first version and began design and construction of the Model II Alligator. They completed the second model in April of 1936. This vehicle was lighter and more easily maneuverable in the water. The water speed of this model was also increased to 5.45 miles per hour. Immediately after testing the Model II, it was torn down and work began on the Model III amphibious vehicle. Five months later, the Model III Alligator was complete and ready to begin testing. This vehicle was slightly faster on land

and water than its predecessor, but the track system was still breaking after only a few miles use. [Ref. 8:p. 29]

In 1937, Donald Roebling finally had an amphibian that met most of his earlier expectations for a rescue vehicle. The Model IV Alligator was a shortened version of the Model III with an improved suspension system. These modifications significantly enhanced the performance and durability of the vehicle. This latest Alligator, which was lighter, faster in the water, more reliable on land and more maneuverable, had a water speed of 8.6 miles per hour and a land speed of 18 miles per hour. The costs for development over the four years for Roebling amounted to $100,000.
[Ref. 8:pp. 31-32]

Since the Model IV Alligator closely resembled Roebling's desire for a rescue vehicle, he did not disassemble this model. As a result of repeated testing of the Alligator in the Clearwater area, the media became interested in Roebling's invention. In the October 4, 1937 issue of Life magazine, Roebling's amphibious vehicle was featured in the Science and Industry section. The amphibian was presented as a very versatile vehicle that was equally impressive in water or on rugged terrain. The positive publicity received by the Alligator was very likely the catalyst Roebling had been looking for to produce customers for his "rescue" vehicle.
[Ref. 8.pp. 29-33]

The Marine Corps became aware of Roebling's amphibian through the story published in Life. In January of 1938, the Marine Commandant, Major General Thomas Holcomb sent the Life magazine to Major General Bradman, President of the Marine Corps Equipment Board and directed him to evaluate Roebling's Alligator for use in amphibious assaults. Initially the board concluded that the Alligator was not suitable for the needs of the Marine Corps. The lack of armor protection and new suspension system contributed heavily to their lack of enthusiasm. However, before dropping the Alligator for consideration, Major General Bradman directed that additional evaluation of the vehicle be conducted. [Ref. 8:p. 36]

During February of 1938 the Marine Corps Equipment Board began a correspondence with Donald Roebling to obtain additional information regarding his amphibian vehicle. Roebling's positive responses to the board's questions prompted the Marine Corps to send an officer to Florida to inspect and evaluate the Alligator. The evaluation convinced the Marine Corps that the Alligator was quite possibly the vehicle to smoothly transition combat power from the sea to land. Based on the glowing report of the evaluation, the Commandant formally requested funds from the Navy to buy an Alligator and test it under military conditions. Unfortunately the Navy's limited funds for 1938 were spent on development of Navy landing craft. [Ref. 8.pp. 37-38]

In October of 1939 the Marine Corps sent a three man committee headed by Brigadier General Emile Moses to Clearwater, Florida to inspect the Alligator and assure Roebling of the continuing interest held by the Marine Corps. After this visit, a second request for funding from the Navy was submitted. This request was successful and by April of 1940 Roebling was under contract to supply the Marine Corps their first amphibian vehicle by November of 1940. [Ref. 8:p. 39]

The vehicle delivered to the Marine Corps was essentially a Model IV Alligator with several military modifications suggested by various Marine evaluators or inspectors during the course of their association with Donald Roebling. The major changes that made this vehicle differ from the Model IV were an engine change and a reduction in overall weight of one thousand pounds. This vehicle was capable of a land speed of 29 miles per hour and a water speed of 9.72 miles per hour. [Ref. 8:pp. 40-42]

After delivery of the prototype vehicle, the Marine Corps conducted a series of tests in different parts of the United States and Caribbean to determine if the Alligator would meet the requirements for amphibious operations. All testing was highly successful and in February of 1941 the Department of the Navy contracted with Roebling for 200 Alligators. The only changes from the prototype would be a higher horsepower, slower speed engine to enhance land operations, and steel plating vice aluminum to provide some protection from small arms fire and more durability against coral and surf conditions. [Ref. 8:p. 43]

The first production amphibious vehicle was delivered to the Marine Corps in August of 1941. It was designated as the Landing Vehicle, Tracked, Model 1 (LVT-1) Amphibian Tractor and had a cargo capacity of 4000 pounds. The LVT-1 was capable of 18 miles per hour on land and 7 miles per hour in the water. [Ref. 8:p. 46]

Starting with the amphibious assault on Guadalcanal in August of 1942, the amphibian tractor was used in every amphibious operation of World War II by Marine Corps and Army units. During the course of the war, the LVT progressed through four cargo versions and two assault gun versions.

After World War II, the Army lost interest in amphibious assaults and the amphibian tractor, leaving the Marine Corps as the sole organization holding this weapon system within the American military. The National Security Act of 1947 recognized the primary mission of the Marine Corps as "seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign." [Ref. 10:p. 118] This Act also charged the Marine Corps with responsibility for development of "amphibious operations which pertain to the tactics, technique, and equipment employed by landing forces."

[Ref. 10:pp. 117-119] With this legislation, the Marine Corps now had a separate and unique mission apart from the Army.

One of the possible reasons why the Army gave up on amphibious operations so readily was the thinking of the senior Army leadership at the time. An example of this attitude was General of the Army Omar Bradley's indication, during testimony before a congressional committee in 1951, that amphibious campaigns were obsolete. Bradley stated, "I am wondering whether we shall ever have another large-scale amphibious operation." [Ref. 11:p. 66]

The thinking behind this statement may have been rooted in the policy of containment which the United States was practicing at the time. Perhaps Bradley and others were remembering the high casualties in World War II amphibious assaults such as Tarawa and Iwo Jima. Also, he may have assumed the only possible war the United States would participate in would be one fought on the plains of Europe between America and our cold war enemy, the Soviet Union.

Whatever the reason, Bradley's statement did prove to be premature, for a year later General of the Army Douglas MacArthur requested the 1st Marine Division to conduct a flanking amphibious assault against the North Koreans. The risky assault at Inchon was very successful and the North Koreans were driven back to their own territory.
[Ref. 12:p. 47]

Many Marines and strategists believe that the landing at Inchon was the final validation of the concept of amphibious assault and the institution of the Marine Corps. Despite Inchon's success, an amphibious assault of this magnitude has not been launched by the Marine Corps since. However, development of improved weapon systems to enhance the amphibious capability of Marines has continued. Since Inchon, the Marine Corps has fielded three successive versions of the "Landing Vehicle, Tracked": the LVT-5 in 1953, which saw action in 62 small amphibious landings and as armored personnel carriers in Vietnam; the AAV7 in 1972, used for the invasion of Grenada; and the AAV7A1, which saw extended use during the Gulf War as an armored personnel carrier. The AAV7A1 is essentially an AAV7 which was upgraded from 1983 - 1986 as part of a Service Life Extension Program. [Ref. 13:pp. 74-76]

D. SUMMARY

Beginning with Gallipoli in 1915, Marine Corps interest in the feasibility of amphibious assaults waxed and waned. With the ascendance of Major General John A. Lejeune as Commandant of the Marine Corps, pursuit of a workable amphibious doctrine moved forward. While the doctrine of amphibious operations was being completed, a concerted effort was made to equip Marines with material to successfully compete an amphibious assault. Vehicles were developed to carry out the mission, notably the LVT Amphibian Tractor and the LCVP. This chapter discussed the development of the doctrine of amphibious assault and the equipment used for this purpose.

III. ADVANCED AMPHIBIOUS ASSAULT

A. INTRODUCTION

This chapter will focus on the rationale for amphibious assaults, both now and into the twenty-first century. In addition, the direction the Navy and Marine Corps defense roles have taken since the demise of the Soviet Union and how this direction impacts the concept of *advanced* amphibious assault will be discussed. This direction, taken collectively from the draft version of Operational Maneuver From The Sea, and the Navy and Marine Corps white paper titled ...From The Sea, defines the concept of Advanced Amphibious Assault (AAA). This chapter concludes by examining how advanced doctrine and technology, as suggested in The Military Technical Revolution, are related to AAA and manifested by the Advanced Amphibious Assault Vehicle (AAAV).

B. AMPHIBIOUS OPERATIONS BEYOND THE COLD WAR

In order to adequately address the advancement of amphibious assault doctrine beyond the cold war and into the 21st century, the question of whether the United States needs to maintain the capability to prosecute amphibious assaults should first be addressed.

1. Background

The demise of the Soviet Union and the Warsaw Pact Alliance has caused the political leadership of the United States to re-evaluate the "mix" of forces required for America's defense needs. For more than 40 years the American military was primarily geared toward the deterrence and prosecution of a war with the Soviet Union and nations of the Warsaw Pact both conventionally and by nuclear means. Since those entities no longer exist, new roles for America's military are being defined. An exception to this need for re-definition of cold war roles affects the United States Marine Corps.

The sole mission of the Marine Corps with regard to war with the Soviet Union was defense of Norway from a Soviet attack, while the Army, Navy and Air Force were primarily geared to meeting the Soviet threat. [Ref. 13:pp. 1 and 3] The primary use of Marines during the course of the cold war was as a quick reaction force deployed on Navy amphibious ships, protecting America's interests throughout the globe. Examples of these types of crisis response are the Mayaguez rescue off Cambodia in 1975, the Grenada operation in 1983, the securing of embassies as was done in December of 1989 during a coup attempt against Philippine President Corazon Aquino, and evacuation of embassy personnel as was accomplished by Operations Sharp Edge in 1990, and Eastern Exit in 1991. [Ref. 13:p. 7]

Although the Marine Corps has not launched a major amphibious assault since the landing at Inchon in 1950, the threat to do so has played a decisive role in present-day operations. For example, during the Gulf War the threat of an amphibious assault tied down eight Iraqi divisions from the area of the main coalition assault and forced the Iraqis to expend resources in constructing barriers to an anticipated amphibious assault. [Ref. 13:p. 6] The amphibious capabilities resident in the Marine Corps also lend themselves to effective disaster relief and humanitarian assistance as was the case during the Bangladesh typhoon in May of 1991 and the start-up of assistance to famine victims in Somalia in 1993. [Ref. 13:p. 1]

Since the amphibious capabilities of the Marine Corps were never really geared toward conflict with the Soviet Union or other Warsaw Pact nations, it could be argued that those capabilities are still needed despite the absence of a rival superpower. Without the Soviet Union's influence over eastern Europe and other countries throughout the globe, some analysts consider the world a much less stable place. Greater instability means, according to this argument, a greater need for the rapid reaction capabilities possessed by the Navy and Marine Corps. One only has to look to the turmoil of former Yugoslavia to gain an appreciation for this argument.

2. The New World Order

The collapse of the former Soviet Union does not represent the only withdrawal of superpower influence in some regions of the world. Because the Soviet Union now lacks influence in various regions throughout the globe, the United States has been able to pull back some of its worldwide presence, thereby further diminishing superpower influence. Since 1990, the United States has initiated a reduction of 38 percent, or 628 bases, in its overseas basing structure. [Ref. 14:p. 15] This reduction not only creates a vacuum of superpower influence in some regions but gives up potential "footholds" for possible use of port or runway facilities in some areas. Without use of existing facilities from friendly nations, the need will exist to obtain such facilities by force. In addition to seizing ports and coastal air facilities, Navy and Marine Forces would provide the initial containment of overseas threats and provide the time necessary to move Army and Air Force units to the theater of conflict. [Ref. 15:p. 10]

The dwindling number of U.S. bases abroad and the existence of only one superpower in the world mean that in future conflicts the Navy and Marine Corps will be employed more frequently, at least to initially secure facilities for use by the Army and Air Force. The Navy, along with Marines, are continuously deployed around the world. These deployments provide a consistent American presence throughout the world as the strategic environment becomes less stable. This continuous American presence reassures allies, deters aggressors and provides training to the Navy and Marines in areas where they may eventually have to fight. Reductions in the number of U.S. forces permanently stationed overseas increases the possibility that Navy and Marine Forces at sea will be the only reaction force near a region in crisis. [Ref. 16:pp. 55-57]

Two-thirds of the surface of the earth is covered by water making access to most countries readily available to the Navy and an amphibious-capable Marine Corps. Additionally, most of the world's capital, technology, industry and population are within 50 miles of an ocean, and almost half of all man-made infrastructure is within 20 miles of a coastline. [Ref. 16:p. 56] Moreover, the preponderance of U.S. interests are readily accessible by the sea, now controlled without challenge by the United States, making the Navy and the Marine Corps uniquely capable of power projection in a world of declining superpower influence abroad. [Ref. 16:p. 56]

3. ...From The Sea; A New Naval Direction

To better face the post-cold war world, the Department of the Navy presented a new direction for the naval Service in a document written by the Secretary of the Navy, Chief of Naval Operations and Commandant of the Marine Corps titled ...From The Sea. This document, published in September of

1992, was in response to the fundamental shift in national security policy articulated by the President of the United States on August 2, 1990. The national security strategy shifted from focusing on a global threat to greater uncertainties in regions of the world considered vital to U.S. national interests. [Ref. 17:p. 1]

...From The Sea was truly a departure for the Navy. Since they were no longer challenged on the high seas by the Soviets the Navy shifted its attention to littoral warfare. No longer would the Navy be primarily structured toward open-ocean warfighting, but would concentrate on power projection from the sea to the littorals, or coastlines, of the world.

This new primary direction for the Navy and Marine Corps provides that Navy and Marine Forces be used as an unobtrusive forward presence which can be withdrawn or enhanced quickly. By concentrating on force projection from the sea, the Navy and Marine Corps can provide the Unified Commander a highly sustainable force that can accomplish the necessary mission; alternatively these forces can seize and defend an unfriendly port or coastal air facility pending arrival of Army and Air Force units. [Ref. 17:pp. 2-3]

...From The Sea not only is a departure from the Navy's primary focus, but it also represents a strengthening of the interdependence of the Navy and Marine Corps. In addition to officially publishing the new Department of the Navy policy regarding the focus of the Navy and Marine Corps team, a joint Navy/Marine Corps Naval Doctrine Command was established to best integrate the joint sea-air-land team. The primary focus of this command is to build doctrine for naval expeditionary warfare. [Ref. 17:p. 7]

C. THE CURRENT STATE OF AMPHIBIOUS OPERATIONS

The Marine Corps has been primarily amphibious in nature since World War II, although some would argue it has been amphibious since 1775. To date, the most obvious changes to the original amphibious concept have been the integration of the helicopter, the Landing Craft Air Cushion (LCAC), and the amphibious assault vehicle to create an amphibious triad. The helicopter has allowed the Marine Corps to launch amphibious operations by air, as well as surface means. Currently, the practice is to launch two-thirds of the assault units by helicopter and one third by amphibious vehicles. [Ref. 12:p. 76] The addition of the airborne assault element to the amphibious operation provides added flexibility to the Marine Corps because of the vertical envelopment capability now enjoyed.

The LCAC is a hovercraft capable of high water speeds while carrying heavy payloads. Some strategists have suggested the LCAC be used for launching the surface-borne assault echelon of amphibious assaults and eliminating the need for a follow-on Advanced Amphibious Assault Vehicle. However, while the LCAC is capable of beyond the horizon launches, it is not designed as an assault craft. It is unarmored, making it vulnerable to small-arms fire and light shrapnel. Moreover, the LCAC would be severely limited once ashore due to its inability to climb hills, breach obstacles over five feet or knock over small trees. The LCAC's proper role is that of a support vehicle, bringing up tanks and heavy artillery after the initial amphibious assault. The LCAC could certainly enhance the capabilities of any amphibious assault, not only with its ferrying of tanks and artillery, but also in meeting logistics needs such as food, ammunition and medical supplies which must be brought up from zero in the early stages of amphibious operations. [Ref. 18:p. 42]

However, the slow water-speed of eight miles per hour of the AAV7A1 and its predecessors have limited the evolution of the amphibious assault over the last 50 years. Infantry occupants of the AAV7A1 can only remain in the vehicle for one-half hour in the water and retain combat effectiveness due to the combination of heat, noise, fumes and motion within the troop compartment. [Ref. 18:p. 40] Therefore, amphibious ships must disembark the surface-element of the assault force no more than one-half hour's ride from the shore. Due to the vehicle's slow-water speed, this distance is approximately 4000 meters, well within sight of the area to be assaulted. Not only does this virtually eliminate any chance of surprise, the slow water-speed also forces the surface element to conduct head-on assaults vice indirect attacks since maneuver warfare from the sea is not an option. [Ref. 18:p. 40] The lack of maneuverability and slow speed in the water make the surface-borne element of the assault more vulnerable to any opposition which would be defending an assaulted coastline.

In addition to being severely limited by its slow water-speed, the current amphibious vehicle also possesses problems associated with being an engineering hybrid of ground and water systems. The AAV7A1, as is true for all its predecessors, is slower and less maneuverable than naval landing craft when in the water, and less mobile and lethal than traditional infantry fighting vehicles (IFV) on land. Because the AAV7A1 cannot compete on land with today's IFVs it is not as useful for land operations due to the speed of the modern battlefield.

The AAV7A1 is also fast approaching the end of its useful service life. This vehicle, fielded in 1972 and designated AAV7, was redesignated as an AAV7A1 after a Service Life Extension Program (SLEP) updated the basic vehicle design. The SLEP conversion took place from 1983 to 1986 and was intended to extend the life of the system to the year 2004. [Ref. 18:pp. 39-41] The deficiencies of the AAV7A1 preclude the Marine Corps from advancing the tactical doctrine of amphibious operations much beyond the level they were during World War II and will not adequately support the concept of Advanced Amphibious Assault.

D. OPERATIONAL MANEUVER FROM THE SEA

Operational Maneuver From The Sea (OMFTS) as drafted by the Concepts and Plans Division of the Marine Corps Combat Development Command (MCCDC) is "the application of maneuver warfare to a maritime campaign." [Ref. 19:p. 1] The intent of this concept is not only to upgrade the Marine Corps' amphibious capabilities, but to fill the void of a diminishing American overseas presence by forward projection of Naval Expeditionary Forces composed of Navy and Marine units.

1. A Giant Leap In Evolution Of Amphibious Operations

The concept of Advanced Amphibious Assault (AAA) is the next step in the evolution of amphibious operations developed by the Marine Corps. This concept of *advanced* amphibious assaults encompasses every amphibious capability possessed by the Marine Corps today and adds the element of operational maneuver from the sea (OMFTS).

The concept of OMFTS lends itself to great flexibility. The ability to use OMFTS as the method of amphibious operations presents commanders with new capabilities and opportunities. Under OMFTS power can be projected from long distances off shore or from closer distances based on the situation. During ship-to-shore movement, surface-borne amphibious forces can approach an area to be assaulted directly or maneuver for an indirect approach. Once ashore, forces can hold coastal areas or penetrate deeper. OMFTS is flexible because of two precepts: operational speed and use of the sea as an avenue of approach. [Ref. 19:pp. 4-11]

Operational speed is important for the obvious reasons of enabling amphibious forces to seize the initiative and retain it, or to continually dictate the pace of battle. Additionally, operational speed allows for launching amphibious forces beyond the horizon or beyond the variable limit of the enemy's perception, perhaps as far as 25 miles from the coastline. By launching amphibious forces beyond the horizon of the enemy, he is unable to determine the intent or objectives and can draw no conclusions about where tactical phases begin and end. [Ref. 19:p. 5]

Seaborne mobility of Naval Expeditionary Forces provides a viable threat around the world to enemies of the United States. This is due to the quick strike capability enjoyed by these forces to any region with a coastal area. Operational speed allows amphibious operations to be launched from beyond the horizon, providing surprise or uncertainty of the assault approach. The world's oceans, as an avenue of approach, provide American access to virtually all regions of the world since the United States is unrivaled in Naval power. [Ref. 19:p. 11]

Using the sea as an avenue of approach for maneuver much the same as land surfaces is a tremendous move forward for amphibious capabilities. This essentially provides the

United States the opportunity to use Naval Expeditionary Forces as floating overseas bases. In many cases these floating forces are as capable as units based overseas without bearing the expense of maintaining them in foreign countries. Because Naval Expeditionary Forces are sea-based, their entry or exit to threat areas can be as quick as the situation dictates. While the sea was once considered a barrier to reaching coastlines, it could now actually enhance our ability to project power effectively without the expense of such a large overseas basing structure.

2. Technology To Support Advanced Amphibious Assault

In order to make the concept of Advanced Amphibious Assault a reality, advanced technology must be put to use to improve deficiencies associated with the current amphibious assault vehicle. The water speed deficiency of the AAV7A1 becomes the limiting factor for advanced amphibious operations. The slow speed of the AAV7A1 requires that amphibious ships be within approximately 4000 yards of the coastline of the area to be assaulted. Because the amphibious ships are within visual range prior to the assault, this gives the enemy time to shift reserves, place mine fields or enhance defenses. Possessing the capability to launch amphibious assaults from beyond the horizon will severely complicate the enemy's defensive decisions, particularly if he has a very lengthy coastline. Without knowing where the amphibious assault will come, he will not know where along his coast he should defend, locate reserves or place water mine fields. [Ref. 20:p. 5]

In March of 1993, the Center for Strategic and International Studies released a paper suggesting that the world is involved in a "Military Technical Revolution." The term, Military Technical Revolution (MTR) has implications for various aspects of military forces in addition to technology. More precisely, the MTR is a "timely combination of innovative technologies, doctrines, and military organizations that is reshaping the way in which wars are fought." [Ref. 21:p. 1]

The argument can be made that the concept of Advanced Amphibious Assault, whether considered revolutionary or merely the natural evolution of amphibious assault doctrine, is the type of innovation discussed by the authors of The Military Technical Revolution. However, the resulting capability achieved by the concept of AAA is undisputedly revolutionary. The addition of OMFTS represents a fundamental advance in amphibious doctrine that the world's oceans would no longer represent an effective barrier to power projection from the United States. Essentially, the sea would represent a potentially friendly "jumping-off" point or gateway for Naval Forces into every nation that owns a coastline. In order to achieve the concept of AAA, there must also be a technological advance to create an amphibious vehicle capable of operating as suggested in Operational Maneuver From The Sea.

Organizationally, the Navy and Marine Corps are already shifting their focus toward support of littoral warfare as demonstrated in the document, ...From The Sea.

The Marine Corps has been wrestling with the type of technology needed to field an amphibious vehicle capable of meeting the objectives of AAA. The vehicle needed to address the concept of AAA must be equally capable on water and land as is emphasized by the OMFTS portion of AAA. The vehicle's needs are broken down into four core capabilities: high water speed (at least 25 miles per hour to achieve beyond the horizon launch capability), high land speed (at least fast enough to keep up with the M1 Abrams tank), enhanced armor protection and greater offensive capability than present. The vehicle desired by the Marine Corps will be one that can ferry troops from ship to shore from beyond the horizon quickly, transition to land smoothly and then serve as an IFV or maneuver element for a land campaign if needed.

Technology to meet Marine Corps needs for an Advanced Amphibious Assault Vehicle has been under development by the Carderock Division of the Naval Surface Warfare Center, a Department of the Navy Laboratory. Carderock has made significant progress in developing and evaluating technology such as the planing hull, armor composites and suspension items necessary to achieve a AAAV. On February 12, 1992 a Propulsion System Demonstrator (PSD) developed by the Carderock Division and the corporate team of General Dynamics and AAI, reached water speeds in excess of 26 miles per hour, setting a new world record for amphibious tracked vehicles. Although the PSD was not a full scale technology demonstrator, it proved the feasibility of the concept design, principally the planing hull, for high-water-speed. [Ref. 22]

Currently, the pacing item for final development of the AAAV is the engine. In order to "lift" the full-sized hull out of the water and cause it to "plane" near the water's surface the engine is required to generate a minimum of 2,600 horsepower and fit within the area constraints of the vehicle so as not to sacrifice cargo space. Traditional IFVs operate at around 600 horsepower taking up a comparable amount of space. [Ref. 22] The AAAV, as envisioned, will be one of the most capable infantry fighting vehicles in the world and it will also be amphibious.

Development of the technologies necessary to make the Advanced Amphibious Assault Vehicle possible has come largely through the efforts of the Carderock Division of the Naval Surface Warfare Center and development contracts awarded to two private corporations. This is most likely due, in part, to the lack of dual use for this system. Private industry is motivated by profit and since no civilian use for a vehicle of this type can be imagined, its development does not proceed unless contracted for. The only subsystem that has seen any dual use application from past amphibious assault vehicles is the suspension for use on heavy-duty logging equipment. [Ref.

23] The history of development of the AAAV would seem to validate the need for Government laboratories to advance technology in areas with no civilian use.

E. SUMMARY

The current and future need for amphibious capabilities for the United States has been addressed and linked to the new focus of the Department of the Navy for operations in the future. For the United States to remain a viable superpower, forward presence and rapid deployment of the American military are necessary capabilities. The Navy and Marine Corps are poised to support these goals by focusing on power projection through the littorals of the world. To help illustrate the desired future capabilities of the Department of the Navy, the Marine Corps has developed the concept of Advanced Amphibious Assault. The Advanced Amphibious Assault concept, and operational maneuver from the sea enhance the Navy and Marine Corps level of power projection. AAA forwards the new naval direction as articulated by ...From The Sea. This chapter has also demonstrated the revolutionary nature of the new doctrine called Advanced Amphibious Assault and detailed the capabilities this doctrine will provide the United States. Finally, the level of technology required to support the new concept of AAA and the methods pursued by the Marine Corps to attain this level were briefly addressed.

IV. METHODS OF ACCELERATING ACQUISITION

A. INTRODUCTION

This chapter will provide a brief overview of the traditional acquisition cycle currently in use for procurement of major weapon systems within the Department of Defense. Also, the distinctions between concurrency and streamlining will be addressed as they relate to the acquisition cycle. Justification for acceleration of the acquisition process for the AAAV by the Marine Corps will be provided within this chapter of the study. Finally, an examination of various methods to accelerate the acquisition cycle and how those methods can speed the procurement of the AAAV will be discussed.

There are methods that can effectively reduce the time required to field a major weapon system without adding prohibitive risk to scarce Government resources or the system program. The intent of this chapter will be to provide some methods of reducing the amount of time taken by the acquisition process to begin fielding Advanced Amphibious Assault Vehicles to Marine Corps units.

B. THE TRADITIONAL ACQUISITION CYCLE

The current acquisition process used by the Department of Defense for procurement of equipment is articulated by the Department of Defense Instruction Number 5000.2.

Prior to the commencement of the acquisition process, determination of a mission need must take place. This happens in the form of a Mission Need Statement (MNS) which can be generated by a military department, the Joint Staff, OSD, or a unified or specified command.

Once the MNS is approved, following a rigorous process within various DOD agencies, a Milestone 0 review will take place to determine whether Phase 0 of the acquisition cycle can proceed. This phase is known as the "Concept Exploration and Definition Phase." During Phase 0 the Government will conduct short term studies to define and evaluate the feasibility of alternative concepts to satisfy the identified mission need.

A Milestone I review will determine the success of Phase 0, and signal the initiation of a new program and Phase I of the acquisition cycle. Phase I is known as the "Demonstration and Validation Phase" (DEMVAL) of the acquisition cycle. As the name implies the primary purpose of DEMVAL is to demonstrate and validate the design approaches and technologies pursued for the system concept(s). The acquisition strategy developed in Phase 0 must undergo refinement during DEMVAL to identify high risk areas and the risk management approaches taken for these areas.

To enter the next phase of the acquisition cycle, the Milestone Decision Authority (MDA) determines if the program is ready to enter Phase II, or "Engineering and Manufacturing Development" (EMD). The objectives of EMD are geared toward risk reduction by translating the most promising design approach developed in Phase I into a stable, producible and cost effective design. The production process to build the system will be validated in the course of this phase. Also, testing during EMD will demonstrate that the system capabilities meet contract specification requirements and satisfy the identified mission need by meeting minimum acceptable operational performance requirements.

A Milestone III review will take place to determine the effectiveness of Phase II and to determine if the program warrants continuation. Milestone III marks the most important decision point in the cycle, due to the fact that a favorable decision allows the system to enter production, committing significant Government resources.

Phase III is the "Production and Deployment" phase of the acquisition cycle. The objectives of this phase include: (1) establishing a stable, efficient production and support base, (2) achieving an operational capability which satisfies the identified mission need, and (3) conducting follow-on operational and production verification testing to confirm and monitor performance and quality and verify the correction of deficiencies.

Phase IV, or "Operations and Support" of the acquisition cycle, begins as soon as completed systems, in Phase III, are delivered to the Government. Entry into Phase IV is not predicated on a successful Milestone IV review. A Milestone IV review will only be scheduled if modifications to the current system are needed.

The preceding paragraphs have provided a general overview of the defense acquisition cycle. There are numerous requirements embedded into each phase for a procurement of any system and there can even be additional requirements depending on the Acquisition Category (ACAT) of the program.

The traditional acquisition cycle is designed to ensure that the best possible system is fielded in a cost effective manner with minimum amounts of risk to the Government. These overarching objectives create a myriad of obstacles to be overcome in progressing from identification of a mission need to fielding a major weapon system.

C. THE ADVANCED AMPHIBIOUS ASSAULT PROGRAM

The Advanced Amphibious Assault Program is currently in the Concept Exploration phase of the acquisition cycle. A Milestone I review is scheduled for the second quarter of FY94. [Ref. 24:p. 2]

Activities to support the future replacement of the existing amphibious vehicle began in 1985. At that time, the Marine Corps directed that a broad range of vehicular subsystems be developed for application to several potential alternatives. By successive integration of these subsystems into scale Automotive Test Rigs (ATR), the technical feasibility of high-water speed amphibious vehicles was demonstrated. [Ref. 25:p. 1]

1. AAAV Mission Need Statement

In 1988, as part of the Marine Corps' continuing mission analysis, deficiencies were identified in assault capability. These shortfalls were based on the over-the-horizon (OTH) amphibious assault tactic and the approaching obsolescence of the AAV7A1 vehicle. These deficiencies revolved around the primary vehicle system (AAV7A1) utilized by the Marine Corps for the execution of amphibious operations.

Based on the vehicle deficiencies, the Marine Corps presented the Advanced Amphibious Assault Vehicle (AAAV) Mission Need Statement to the DOD with its Program Objective Memorandum (POM) 90-91 submission. This MNS identified the need for a replacement system to the AAV7A1. The Defense Resources Board (DRB) and Defense Acquisition Board (DAB) supported the Marine Corps' MNS and the request to commence a major system acquisition cycle to correct the deficiency. In accordance with the DOD 5000 series of directives, however, the DRB and DAB directed the Marine Corps to examine a wider range of concept alternatives than the three systems identified in their Mission Need Statement for a follow-on high-water speed amphibian vehicle. The Marine Corps was also directed to seek commonality with the U.S. Army Heavy Force Modernization (presently Armored Systems Modernization {ASM} program), and examine as a potential system alternative the Landing Craft Air Cushion (LCAC) as acquisition objectives. [Ref. 26:p. 5]

Because the scope widened, the Under Secretary of Defense for Acquisition (USD{A}) retitled the program as Advanced Amphibious Assault (AAA). The revised Mission Need Statement was received as an attachment to both the Acquisition Decision Memorandum (ADM) in July of 1988 and the Program Decision Memorandum (PDM) in August of 1988. [Ref. 26:p. 5] Release of the ADM signaled the approval to start Phase 0 of the acquisition cycle for AAA.

2. AAA Concept Exploration

At Milestone 0 of the DOD Acquisition Cycle, the Marine Corps was charged with expanding the scope of alternatives to meet the deficiencies identified in the Mission Need Statement. This was accomplished by the identification of thirteen alternatives to be analyzed. These candidate systems were divided into the four categories:

high-speed amphibians, slow-speed amphibians, non-amphibians and non-vehicles. A breakdown of the alternatives by category is provided in Appendix B. [Ref. 22, 26:p. 7]

Prior to the Cost and Operational Effectiveness Analysis (COEA) being conducted on all thirteen alternative systems, an effort was made to cull out the less capable systems. The purpose of this "pre-analysis" was to limit the COEA effort to a more manageable number of alternatives. This screening was based on a performance analysis including ship-to-shore movement, system mobility ashore, survivability, and lethality. This pre-analysis resulted in six systems being removed from consideration due to various weaknesses in those areas. [Ref. 22]

The remaining seven alternatives were then analyzed for cost and operational effectiveness for the Marine Air Ground Task Force (MAGTF) when utilizing each system. Each alternative was tested for its effectiveness by a large, force-on-force simulation known as the Amphibious Warfare Model. At the conclusion of the COEA, in March of 1991, the alternatives were reduced to three systems. The Program Manager (PM) assessed all concepts to be of medium to low technical risk and all were deemed to be within its affordability range. Of the three remaining systems the high-water speed amphibian, or AAAV(F) was evaluated as the best and most effective overall performer. The primary eliminating factor for the low-water speed amphibian, or AAAV(S) and the

APC(X), were relatively slow speeds that prohibited full effectiveness of OTH tactics. [Ref. 27:p. 22-28]

In November of 1991, the Joint Requirements Oversight Council (JROC) reviewed the performance thresholds and objectives for the AAA program and validated the need for the AAAV(F). [Ref. 26:p. 5]

3. Acquisition Strategy

The Acquisition Strategy was established by the Program Manager prior to the JROC's approval of the AAAV(F) system in November of 1991. This strategy is geared toward the acquisition of the AAAV(F) as a new vehicle for satisfaction of the Marine Corps' need for a system to meet the deficiencies outlined in their Mission Need Statement of July 1988. [Ref. 22]

Under the traditional approach to acquisition of major weapon systems for DOD, it has been estimated that the AAAV would not be fielded to Marine Corps units until the year 2007. [Ref. 22] Full operational capability would not be reached by the Marine Corps until 1 October 2009. [Ref. 28:p. 11]

Because the existing amphibious vehicle, the AAV7A1, is already 21 years old and will reach the end of its useful service life in 2004, the Marine Corps wants to field a replacement system sooner than presently anticipated under the traditional acquisition cycle. [Ref. 18:pp. 39-41]

Additionally, the emerging pre-eminence of Naval and Marine Corps Forces for employment in America's post cold war approach to overseas presence enhances the need for a AAAV to better support "from the sea" operations. [Ref. 29:p. 15]

D. ACCELERATING PROCUREMENT OF THE AAAV

After a brief explanation of the traditional acquisition cycle, the Program Manager's Notebook states that, "Not every program follows this exact format. In fact, tailoring is highly encouraged." [Ref. 30:p. 1.1-8] The extent of modification, or tailoring, which can be applied to the acquisition cycle is dependent on factors such as degree of program risk, type of program (new, high technology development or nondevelopmental items) and the time frame in which the system will be required. The base requirement of DOD policy for procurement, as rooted in the Office of Management and Budget (OMB) Circular Number A-109 and the DOD 5000 series of directives, is that acquisition should be executed in an efficient and effective manner to achieve the operational objectives of the Armed Forces of the United States. [Ref. 30:p. 1.1-8]

The intent of this section will be to examine various methods, within current law, of tailoring the acquisition cycle to accelerate or streamline the procurement process for the AAAV. The focus of this effort will be primarily geared toward events that traditionally occur in Phases I and II of the acquisition cycle for major weapon systems and management approaches.

1. Concurrency and Streamlining

Prior to initiating a discussion of ways to accelerate the acquisition cycle for the AAAV, some distinction must be made between traditional methods used to shorten the procurement process. Two methods that have been used to shorten the acquisition cycle are concurrency and streamlining. Traditionally, some within the acquisition community have had the tendency to use these terms interchangeably, obscuring their meanings.

Concurrency is defined as, "part of an acquisition strategy which would combine or overlap phases of the acquisition process, or development test and evaluation (DT&E) and OT&E." [Ref. 31:p. B-17]

The Department of Defense refers to streamlining as follows:

> *Acquisition Streamlining*-Any effort that *results in more efficient and effective use of resources to design and develop, or produce quality systems. This includes ensuring that only necessary and cost-effective requirements are included, at the most appropriate time in the acquisition cycle, in solicitations and resulting contracts for the design, development, and production of new systems, or for modifications to existing systems that involve redesign of systems or subsystems.* [Ref. 31:p. B-3]
>
> *Streamlining-(1) An acquisition strategy communicating what is required in functional terms at the outset of DEM/VAL phase. Allowing flexibility for application of contractor's expertise, judgment and creativity in recommending detailed MILSPECs/MILSTDs and other detailed*

requirements as development nears EMD and production. Required by DODI 5000.2. Ensures only cost-effective requirements are included in solicitation and contracts; (2) broadly used to denote efforts to shorten the acquisition process. [Ref. 31:p. B-105]

The obvious difference between concurrency and streamlining, in either form, is that concurrency makes no effort to evaluate for eliminating any unnecessary requirements in the acquisition cycle. Instead, concurrency concentrates on the acquisition and testing processes in an effort to overlap the phases so that all tasks can be accomplished in the least amount of time possible. Streamlining, on the other hand, assumes the possibility of eliminating some phases of the acquisition process.

In effect, concurrency could be achieved through construction of a network model (Program Evaluation Review Technique {PERT} network diagram) of integrated activities and events and evaluating the time required to complete the project and whether activities are dependent or not on preceding events. [Ref. 32:pp. 667-670] For example, some activities are not dependent on others; therefore, little reason would potentially exist to await prior test results before starting another test. Concurrency can be an effective method to shave time from the testing process, but it is limited to only small savings over the life of the acquisition cycle since no steps are deleted.

By contrast, streamlining is required by DOD directive. The implication from the definition is that only the minimum requirements of the acquisition cycle which support efficiency and effectiveness and those requirements written into public law are mandated for use in the procurement process.

The question must then be asked, "Why are there so many burdensome checks and balances built into the traditional acquisition cycle?" One answer to this question is that there is a tendency for Government officials to mistrust or hold an adversarial relationship with contractors, which seems to encourage these officials to add, not drop requirements. Media attention to acquisition problems such as the Navy's A-12, the Air Force $600 coffee pots, and the Army's Sergeant York program make DOD officials very leery of eliminating any part of the acquisition cycle whether it is mandated by public law or not. And lastly, DOD acquisition of major weapon systems requires the expenditure of tremendous amounts of taxpayer dollars which motivates officials to scrutinize every program aspect in an effort to protect the public trust.

However, there are methods that can effectively reduce the time required to field a major weapon system without adding prohibitive risk to scarce Government resources or the acquisition process.

2. Tailoring The Acquisition Cycle For The AAAV

In regard to streamlining the acquisition cycle for the AAAV, determination must be made as to whether conditions exist within the program that support a viable streamlining effort. An important element to streamlining the acquisition cycle is the ability to tailor the process to fit the program. The viability of tailoring the acquisition cycle to fit a specific program can be determined by answering this fundamental question: Does the program lend itself to tailoring the acquisition cycle, for streamlining based on an acceptable level of program risk, the system time-frame requirements, and the technology involved with the program? [Ref. 30:p. 1.1-8]

a. Program Risk

Tailoring the acquisition cycle for procurement implies that only the steps deemed necessary for that specific procurement are required to achieve program success. While it is difficult to forecast program success early in the acquisition cycle, there are indicators that can be used to determine if tailoring is feasible for a system such as the AAAV.

The AAA Program is currently in the "Concept Exploration and Definition Phase" with a Milestone I review scheduled for March of 1994. Success at the MS I review will allow formal program initiation and entry into the "Demonstration and Validation" Phase of the acquisition cycle. As was stated earlier in this chapter, the purpose of DEMVAL is to prove the feasibility of the concept selected by the

Program Office to fill the Mission Need Statement. The AAA Program Office has tested three scaled prototypes of the AAAV. One was a Government Built Vehicle, one was a "planing hull" design from General Dynamics, and the last was a "hydrofoil assisted planing hull" from FMC. All were scale versions and were successful in meeting or surpassing performance requirements. The prototype's proposed armor has been live fire tested, their hydro appendages have been tested, and full size water jets have been built and tested. Additionally, two independent testers have evaluated full-scale mock ups of these projects. [Ref. 22]

The high-water speed requirement has already been validated through use of scaled technology demonstrators constructed for the AAA Program Office. This testing would normally occur during the DEMVAL phase, but was conducted earlier as an effort to reduce program risk and prove the concept. Additional testing on subsystems, crucial to the high-water speed requirement for armored vehicles has also been successfully accomplished prior to Phase I of the acquisition cycle, further reducing risk to the program. [Ref. 22]

Since the desired concept to fulfill the Marine Corps' requirement for *advanced* amphibious assault has been proven to be feasible, Phase I represents an area where time spent on concept validation can be reduced. The Program Office could also request early approval of their Acquisition

Strategy by the USD{A&T} to release to industry an EMD Request For Proposal (RFP) in advance, or absence of a Milestone II review. [Ref. 33:p. 31]

b. Time Requirements

The traditional acquisition cycle will provide the Marine Corps a full operational capability of AAAVs by October of 2009 under the best of circumstances. [Ref. 28:p. 11] Since useful life of the current system for amphibious operations ends in the year 2004, the Marine Corps will be without this portion of the amphibious triad for nearly six years. Even if Fleet Marine Force units could operate with the existing system for the six year interval between AAV7A1 obsolescence and AAAV fielding, the current system does not adequately support the concept of *advanced* amphibious operations or OMFTS.

The urgency of need for fielding the AAAV to Marine Corps units should be considered a vital requirement by DOD based on the increased level of overseas presence forecasted for the Navy and Marine Corps resulting from DOD's The Bottom-Up Review. [Ref. 29:p. 15]

c. Program Type

Program type is meant to imply the level of technical development required for a system. This would generally be broken down into new or high technology development, or non-developmental items. [Ref. 30:p. 8]

The AAAV falls somewhere in the middle of these two categories. The technologies required to achieve the AAAV are not new or really considered to be on the high end of technology; however, the integration of all the system requirements into one vehicle is a significant challenge. [Ref. 22]

System integration of this magnitude might preclude streamlining a program, since contractors and the Government would be starting from scratch to encompass all system requirements in one vehicle. However, this is not the case with the AAAV. Development has already taken place for this integration in both industry and the Government. As stated earlier, the concept of high-water speeds was proven by General Dynamics and FMC, as well as the Naval Surface Warfare Center (Carderock Division). [Ref. 22]

3. Evolutionary Acquisition

Evolutionary acquisition is defined by the Department of Defense as:

> *Evolutionary Acquisition - An acquisition strategy in which a core capability is fielded, and the system design has a modular structure and provisions for future upgrades and changes as requirements are refined. An evolutionary acquisition strategy is well suited to high technology and software intensive programs where requirements beyond a core capability can generally, but not specifically, be defined.* [Ref. 31:p. B-36]

Evolutionary Acquisition is an acquisition strategy that can be used to procure a system expected to evolve during the course of development within an approved architectural framework in order to achieve an overall systems capability. The underlying premise in evolutionary acquisition is the need to field a well-defined core capability quickly in response to a validated requirement, while planning for incremental upgrades to improve the system after fielding. Each incremental improvement is treated as a unique acquisition based on continuous feedback from developers, testers and users of the system. [Ref. 30:p. 1.15-2]

To successfully achieve evolutionary acquisition, the requirements must first be defined for the general outline of the system, and then a sequential identification of sub-systems for incremental improvement, or upgrade must be completed. [Ref. 30:p. 1.15-2]

An evolutionary acquisition strategy for the AAAV would involve fielding a vehicle to Marine Corps units that possesses the following core capabilities:

1.) Water speed greater than 20 knots

2.) Cross country speed equal to M1A1 Tank (45 MPH)

3.) Armor protection against heavy automatic weapons, Anti-Personnel mines and artillery fragments.

4.) Offensive firepower to defeat all light armored vehicles of the time frame.

5.) Carry reinforced rifle squad (17-18 Marines)

6.) Provide NBC protection for crew and embarked Marines. [Ref. 22]

The vehicle design to achieve the identified core capabilities would be identified early in Phase I and become essentially "frozen" for the remainder of the acquisition cycle. This technical approach would be an innovative application of mature technologies yielding a system with major operational advantages over the current system. Only evolutionary extensions of proven technologies would be applied to the vehicle after the base system is fielded. [Ref. 34:p. 9]

By establishing the core capabilities required this early and freezing the design, the Government provides the contractors a fixed target or clearly identified goal to work toward. The requirements are locked in place, unable to shift, enhancing the contractor's ability to more rapidly arrive at a configuration to meet the required capabilities. Inherent in evolutionary acquisition is the ability of the contractor to design an end item capable of accepting leaps in high technology areas such as software or communications equipment so that the overall system is not obsolete when fielded, or shortly thereafter.

4. Down-Select To One Contractor

Over the past several years the Congress and Executive Branch, through the Department of Defense, have demonstrated a strong preference for competition in all phases of the acquisition process. These preferences have been expressed in legislation and directives. [Ref. 35:p. 6]

The Competition in Contracting Act of 1984 (CICA) strongly affirmed that competition will be the standard acquisition method used, leaving sole source procurement as an exception. [Ref. 35:p. 6] Also, the FY1985 Defense Appropriations Act stated:

> None of the funds made available by this Act shall be used to initiate full-scale engineering development of any major defense acquisition program until the Secretary of Defense has provided to the Committees on Appropriations of the House and Senate:
>
> a. A certification that the system or subsystem being developed will be procured in quantities that are not sufficient to warrant development of two or more production sources, or
>
> b. A plan for the development of two or more sources for the production of the system or subsystem is being developed. [Ref. 36:p. 647]

The Department of Defense requires the acquisition strategy to contain provisions for obtaining competition at each phase of the acquisition process to include planning for competition for technologies and ideas in the early phases of the acquisition cycle. Also required is the use of competitive procedures that provide the greatest benefit to the Government. [Ref. 37:p. 1-6]

The mandate for competition is further delineated by the Secretary of the Navy in SECNAVINST 4210.6A of 13 April 1988, which requires:

> The development of each project/program will begin with a minimum of two contractors/contractor teams performing concurrent but separate development at which time it will normally be narrowed to two contractors developing a system to one design.

With so much emphasis toward the use of competition in Government acquisition, the feasibility of down-selecting to one contractor early in the acquisition cycle might be questioned. However, waivers to the competition requirements are allowed when deemed appropriate.

The relatively low number of AAAVs that are anticipated to be purchased (approximately 330) [Ref. 22] implies that a down-selection to one contractor, or "Winner-Take-All" award will take place at some point prior to production due to economies of scale. The "Winner-Take-All" award has been observed to actually increase the projected cost savings of the contract by eliciting a reduced price for the effort involved. This observation is supported by the following reasons: [Ref. 35:p. 33]

1. Winner-Take-All does not sacrifice economy of scale the way dual sourcing must.

2. The splitting of a production quantity between two sources reduces the learning effect that eventually results in potential savings.

3. There is no second place or tomorrow in winner-take-all awards.

4. Due to the unique characteristics of weapon systems and the costs of keeping facilities idle, it is doubtful that a contractor will be available or capable of production in the future once a contract is lost. This fact necessitates a true "best and final offer" to attempt to secure the contract. The

exceptions to this point are those items for which a commercial market exists.

The reasons listed above were highlighted in 1986 by the Center for Naval Analysis (CNA) in a report titled, Evaluation of Models and Techniques for Estimating the Effects of Competition. The current environment of declining defense budgets and a reduced defense industrial base would make those same reasons identified by the CNA even more compelling today.

In the case of the AAAV procurement, the requirement to engage in competitive prototyping, and further competition could be waived by the Department of Defense. Currently there are two contractors actively engaged in pursuit of building the AAAV for the Marine Corps. One is comprised of the FMC/AAI team, while the other contractor is the General Dynamics Land Systems Division. Both contractor approaches to the AAAV are very similar in that they have each embraced the use of "planing hulls" to achieve high-water speeds for the system. [Ref. 32 & 38] Therefore, little distinction exists in the technical approaches presented by each contractor to achieve the requirements for developing an AAAV.

Down-selection to one contractor should occur shortly after the Milestone I review, so that the Government could establish a close relationship with the selected contractor to help speed the final development and production start of the system. Working closely with two contractors would be more costly and difficult due to the dangers of technology transfer between competitors through the Government.

5. Concurrent Engineering

A method that could potentially shorten the acquisition time for the AAAV is to encourage contractors to use the concept of concurrent engineering in development and production of their system. As defined by DOD:

> *Concurrent Engineering* - *A systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause developers, from the beginning, to consider all elements of the system life cycle from requirements development through disposal, including cost, schedule and performance.* [Ref. 31:p. B-17]

Concurrent Engineering is actually comprised of several elements, including multidisciplinary teams, computer aided tools, and others related to systems engineering. The concurrent engineering and systems engineering relationship can be described as the key management approach for accomplishing the systems acquisition process, with systems engineering as the primary technical tool for facilitating concurrent engineering. [Ref. 39:p. 2]

Viewing the manufacturing company from a more integrated perspective is a requirement for using concurrent engineering. The intent is to join and extend the product and process design functions past individual departments and beyond the enterprise as a whole, tapping into the customer and supplier chain. The objectives of concurrent engineering are: to provide more effective product designs to meet customer needs and quality expectations; to design products and the manufacturing process simultaneously; to improve time to market; and to simultaneously link producible designs to high-productivity processes. [Ref. 39:p. 4]

At the earliest stages of development, functional areas within a company are blended together under concurrent engineering. This helps to avoid problems that may potentially arise in production, quality assurance, and market acceptance. At every stage of the product cycle, customer requirements are incorporated into available company resources. [Ref. 39:p. 4]

Concurrent engineering has been made even more effective with the use of computers and computer tools such as computer aided design (CAD), computer aided manufacturing (CAM), and computer aided engineering (CAE). Use of these types of systems can eliminate the need for paper drawings and can significantly reduce the time required to develop a component. [Ref. 39:p. 4]

American industry has been using the concept of concurrent engineering for some time. A recent success of this development process was Chrysler's experience in producing the "Viper" automobile. The Viper project started in 1989, the prototype was used as the Indianapolis 500 pace car in 1991, and limited production began in 1992. All this was accomplished for under $100 million, or 5 percent of what car companies usually spend on new-car designs. [Ref. 39:p. 13]

Chrysler put together a team of 75 people from race-car teams, designers and manufacturers. Heavy use of computers was a key factor in scheduling, design and manufacturing. Half of the tooling came from CAD without the use of paper drawings. This project also represented the first time that PERT-type computer programs were used to track progress of a program at Chrysler. The key to the success of Chrysler's Viper development team revolved around formulating an early time and cost schedule and aggressively following it, through teamwork and exploitation of computer-based tools. [Ref. 39:p. 13]

Although it may be difficult for the Government to influence the way a commercial contractor develops a system, the potential time and monetary savings of concurrent engineering are impressive. Development methods similar to concurrent engineering such as Lockheed's "Skunk Works" have also been quite successful in their ability to produce a superior design, such as the U2 and SR-71, in minimum development times. [Ref. 39:p. 3]

It may be possible to take the idea of concurrent engineering a step further by adding the customer to the development team. In the case of developing a weapon system for the Department of Defense this could involve assigning one or two military representatives and Government engineers to the contractor's development team. This would involve all levels of the contractor's organization in the design effort and would include the customer as well. It would also serve to lessen the adversarial relationship sometimes shared between the Government and the contractor and could keep both sides better informed of what is taking place with development of the system.

6. Delete Phase II

As stated in the Program Manager's Notebook, each acquisition strategy should be tailored to fit a specific program. The AAAV is in a unique position for tailoring due to the early efforts at risk reduction and proof of concept feasibility by the AAA Program Office. [Ref. 22]

Since many of the requirements of Phase I of the acquisition cycle have already been accomplished prior to a Milestone I review, a departure from the typical acquisition cycle can be achieved. The AAA Program Office is scheduled for a Milestone I review during the second quarter of FY94. Once approval is received for the start of Phase I, the driving factor is completion of development of a power-plant to support a full-scale demonstrator. This engine will be required to produce at least 2600 horsepower for the vehicle to achieve high-water speeds. Currently the AAA Program Office has contracted for development of such an engine with Motoren Turbinen Union (MTU). [Ref. 22]

A full-scale demonstrator should be contracted for after approval to start Phase I. Once a suitable engine has been developed and produced by MTU, the power-plant can be integrated in the full-scale demonstrator. Providing these efforts are successful, the full-scale ATD could be used for DEMVAL and as a prototype vehicle.

This represents a significant departure for acquisition of a major weapon system. The feasibility of this approach rests on the fact that most of the technology needed to achieve a AAAV is already in existence and has been effectively demonstrated. The 2600 horsepower engine is the pacing item needed to make the AAAV a reality and development of that engine is proceeding smoothly. [Ref. 40 & 41]

E. SUMMARY

This chapter briefly presented the traditional acquisition cycle to provide a baseline comparison of the requirements that must be achieved to field a major weapon system. Moving from phase to phase as described illustrates the "business-as-usual" approach to acquisition of defense weapon systems.

Methods of accelerating the acquisition cycle for the Advanced Amphibious Assault Vehicle have been examined during this portion of the study. The methods selected can be applied to other systems, although moving from Phase I directly into production is only recommended due to the prior efforts at risk reduction undertaken by the AAA Program Office.

The use of concurrent engineering and an early freeze of the vehicle core capabilities could be essential tools to use the ATD as a prototype and transitioning into low-rate initial production. Concurrent engineering could establish the end item as the goal early in the development process, based on fixed core capabilities. Rapid development of a quality weapon system at low cost may be possible for a defense contractor as it was for Chrysler to produce the Viper in three years at 5 percent of traditional automotive development costs.

The key to the use of concurrent engineering, and taking it a step further by integrating Marine Corps personnel and Government engineers on the development team, is down-selection to one contractor early in the acquisition process. Ending the competition between contractors early ends the added costs of carrying two contractors. It also ends the burden and cost of testing two vehicular prototypes.

V. EVALUATION OF ACCELERATION METHODS

A. INTRODUCTION

The purpose of this chapter is to establish critical criteria to evaluate the four methods for acceleration of the acquisition cycle for procurement of the AAAV identified in Chapter IV of this study. Each method will be presented, and advantages and disadvantages will be discussed. Based on the relative merits of these methods, recommendations will be provided on whether to adopt these acceleration methods.

B. EVOLUTIONARY ACQUISITION STRATEGY

The first approach to accelerating the acquisition of the AAAV is to adopt an evolutionary acquisition strategy. The intent of such a strategy would be to establish core capabilities required for the AAAV, freeze those requirements for development and production, while planning for future upgrades after the system has been fielded to Marine Corps units.

1. Advantages

Perhaps the biggest advantage to adopting an evolutionary acquisition strategy is that planning for future upgrades would be taken into account early in the acquisition process. Component upgrades in areas of computer software or communications are especially pertinent to this strategy since technical advances in those areas are so difficult to forecast. By accepting this premise early, the contractor needs only to concentrate on mature technologies, understanding that if a technological advancement occurs in a sub-system later, it can be applied when the new development is mature.

With this strategy, the Government and contractor also have the advantage of knowing that the core requirements are frozen and will not continually be changed in an effort to address a changing threat environment. This means that a system can be developed and fielded sooner because the stationary requirements have been frozen earlier in the process. The basic philosophy of this strategy is tied to the need to field a well-defined core capability quickly, responding to a validated requirement. [Ref. 30:p. 1.15-2]

2. Disadvantages

One of the advantages for using an evolutionary acquisition strategy, however, could also be considered a prime disadvantage to weapon system procurement. The early freeze of core requirements in a weapon system could lead to the fielding of a weapon system that is obsolete at or shortly after deployment. In other words, the frozen requirements of 1993 may not be appropriate to the needs in 2008 when the system is fielded. This assumes that the Government and contractors are working in somewhat of a vacuum, basically ignoring significant advances in threat technology or weaponry and continuing to pursue a system design that will be obsolete once fielded. The user, or agency, must be willing to accept an initial warfighting capability and acknowledge that the program, or system, will become something more over time as certain technologies advance. [Ref. 42]

Another disadvantage is that once a design to fill the requirements has been selected, research may not be continued to search for alternative methods of satisfying the requirements desired. This might end promising research into technologies that could very well be superior to those selected. It could halt technological breakthroughs which might benefit this weapon system and others as well.

3. Analysis

The author would argue that the advantages of evolutionary acquisition far outweigh the disadvantages, based on the uniqueness of the AAA program.

The disadvantage to fielding a system that might be obsolete upon deployment due to a freeze in requirements does not really apply to the AAAV. The amphibious mission of the Marine Corps is one which is very general in nature. For example, the amphibious capability was never geared solely to fighting the former Soviet Union. The capability to conduct amphibious operations is an ability geared to any region of the world as has been since its inception. Therefore, the likelihood the requirements would change between now and deployment of the system is remote. Additionally, the AAAV as envisioned will be so advanced over the current vehicle used for amphibious operations, the AAV7A1, that once fielded Marine Corps units will be more capable than ever before.

The potential for an end to research for better methods to achieve an AAAV is unlikely due to the Government's own laboratory research efforts at the Naval Surface Warfare Center (Carderock Division). The engineers at this center have researched and validated technologies for several years to achieve high-water speeds for armored vehicles, as well as other technologies to improve Marine Corps amphibious vehicles. This research is ongoing and appears it will continue in the foreseeable future, especially in areas such as composite armor, suspension technologies and band track. The Carderock Division of the Naval Surface Warfare Center could arguably be the best center of knowledge for technology affecting amphibious vehicles in the world.

C. DOWN-SELECT TO ONE CONTRACTOR

The second recommendation for accelerating the acquisition cycle for the AAAV listed in Chapter IV was to "down-select" to one contractor early in the procurement process. Currently there are two contractors who are actively engaged in research and development to build AAAVs for the Marine Corps.

1. Advantages

Down-selection to one contractor early in the acquisition cycle would benefit the Government in that they would only have to work with one contractor through development and production of the system. This would eliminate the concern over technology transfer between competitors through the Government and allow for a closer Government-contractor relationship during the life of the project.

Using one contractor through most of the process will reduce the amount of testing and evaluation required by half since only one contractor would remain. Not only would testing for two competitors eat up time in the acquisition cycle, it would also greatly increase the costs of testing for the Government.

2. Disadvantages

A significant disadvantage to choosing one contractor early is the loss of competition in all phases of the acquisition process. There are those who will argue that the longer competition is maintained in the acquisition cycle, the better price the Government will receive for the product. They feel without competition there is a tendency for contractors to overcharge the Government, or to be less creative in holding down their costs.

Some would contend that without competition the Government loses its ability to compare technologies or systems among contractors. Without more than one contractor, the Government can only evaluate the system on its own merits. If there are other technologies available to accomplish the requirements of the system, they cannot be evaluated since the single contractor involved will probably be using only a single concept.

3. Analysis

The purpose of this study is not to determine if competition or sole source procurement is the most advantageous or cost effective acquisition method for the Government. However, there are factors unique to the AAAV that should be addressed in making this determination.

A sole source procurement for AAAVs is destined to occur at some point in the acquisition cycle due to the economies of scale associated with the relatively low number of vehicles anticipated to be procured. Contractors normally experience "learning" as production of a system proceeds over time. Their manufacturing processes mature, the efficiency of assembly line workers improves and as with any process, the more it is practiced, the better it is executed, resulting in cost savings to the buyer. This factor alone should be reason enough to warrant a scle source procurement based on dilution of the effect of learning that would occur if two manufacturers were used. There is simply not enough work with this program for two defense contractors to be carried into production of the AAAV.

Could two contractors be used through development of the AAAV? This might be a viable strategy if there were competing technological alternatives among the contractors. However, both contractors are proposing essentially the same technological approach to building an AAAV. Because there is little need for comparison among technologies or approaches between the contractors, there is no need to carry both through development of the concept. Competition through development would exist only for the sake of competition and would serve to double the expenses to the Government through this phase and increase the amount of time necessary for testing. Additionally, the Government possesses an enormous amount of technical experience with amphibious vehicles and could significantly reduce the development time required of a contractor by establishing a close Government-contractor working relationship. Carrying two contractors would make such a relationship more difficult based on the differing geographic locations of the contractors and the potential for technology transfer through the Government.

Some would still argue that carrying competition out as long as possible will eventually result in a less expensive product for the Government when, or if, down-selection is finally made. The author doubts the validity of this argument based on these reasons earlier articulated in Chapter IV:

1. No sacrifice to economy of scale through winner-take-all award.

2. Dilution of learning effect by splitting production quantities among multiple contractors.

3. No tomorrow for losing contractor in winner-take-all awards.

4. Early "best and final offer" from contractor when no commercial market exists due to costs of keeping facilities idle once a contract has been lost.

These arguments were made in 1986 when defense spending was peaking for the United States and the defense business was "booming" for contractors. Today defense spending continues to decline, which means there is less business for defense contractors to compete for. This trend makes those arguments from 1986 more legitimate than ever before.

D. CONCURRENT ENGINEERING PLUS

The concept of concurrent engineering was suggested primarily to enhance the development of the AAAV for the Marine Corps. Concurrent engineering, or management systems closely related to it have been highly successful in the quick development and production of complex systems. Chapter IV provided examples such as the U-2 and SR-71 for the Government and the more recent example within private industry of the Chrysler Viper. Most examples of concurrent engineering have indicated that the customer or a close representation of the customer was a part of the concurrent engineering effort. For example, race car drivers were part of the development effort on the Viper project for Chrysler. For concurrent engineering to be most beneficial to the Marine Corps in development of the AAAV, the author believes use of Marines and Government engineers on the contractor's development team is essential.

1. Advantages

The fundamental requirement for use of concurrent engineering is to view the development process from a more integrated perspective. This requirement is the principal advantage to using concurrent engineering. By integrating all functional departments into one team from the beginning of development, potential problems that typically arise in production can be avoided. Supportability issues can be addressed and resolved before the system is fielded. By involving the customer early in the process, his requirements or concerns can be incorporated into the effort and be satisfied.

Concurrent engineering makes heavy use of computer tools such as CAD, CAM, and CAE. Use of these types of systems can eliminate the time and expense of paper drawings when designing components or tooling. Developmental testing is also an area where time and monetary savings could be realized through the use of computer simulations.

Using Marines and Government engineers would be an invaluable advantage to both the contractor and the Government in development of the AAAV. The contractor would reap the benefits of having ready access to experts in the area of amphibious vehicles and operations. He would have the advantage of involving the Government in the development process which would help to avert any potential misunderstanding of requirements. Government representatives in the contractor's facility as part of the team would also help to subdue the traditional adversarial relationship held between industry and the Government.

The advantages to the Government are somewhat related to the advantages for industry. By establishing such a close relationship with the contractor for development of the AAAV, the Government will become "co-owners" of the system early in the acquisition cycle. Development team membership for the Government representatives will ensure that user input is heard and carefully considered, if not implemented. [Ref. 42]

2. Disadvantages

A potential disadvantage of the concurrent engineering approach is the tendency of this approach to add to the number of changes which occur during production of the system. Changes translate to increased costs for the system. This potential of increased costs is the primary reason that concurrent engineering does not enjoy much popularity with the Congress.

3. Analysis

The full integration of all levels of system production, logistics, and the Government in concurrent engineering and aggressive use of computers in this process could potentially shorten the time traditionally taken to develop a system, and could also do so more cheaply. One only has to look to the development of Chrysler's Viper to recognize these possibilities.

The real issue to be addressed with respect to concurrent engineering is: How is the threat of costly production changes averted? This can be addressed in a manner similar in approach to evolutionary acquisition. Since changes can be expected to occur in the development of the system, they should be encouraged to the fullest in the early stages of this development. However, once the third or fourth LRIP vehicle is produced, the changes should not be applied until after the production vehicles have been delivered, and then as separate acquisitions. The design of production vehicles would become frozen at the third or fourth LRIP vehicle in much the same manner as the requirements were frozen early in the evolutionary acquisition cycle. Incorporation of this standard into the acquisition strategy should adequately address the fears of costly changes since no changes would be allowed in production.

E. DELETE PHASE II

On the surface this method of accelerating the acquisition cycle for the AAAV looks very risky and perhaps a little unrealistic considering that Phase II of the acquisition cycle is engineering and manufacturing development. Many in the acquisition community consider this to be the most important phase of the cycle because it precedes the Milestone III decision point where determination is made about whether to build the system.

This method as envisioned is not really a deletion of Phase II. All of the requirements of Phase II need to be accomplished in order to mitigate program risk and produce a system in the most cost-effective manner possible. The deletion is in name only since those requirements of Phase II would be accomplished in Phase I (DEMVAL) after the Milestone I review. This is possible since the concept has already been demonstrated and validated prior to Phase I. In reality, the only deletion in the acquisition cycle for the AAAV is the Milestone II review, since Phase II requirements would occur in Phase I of the process. Then, when ready, a Milestone III review would occur, signaling the start of vehicle production.

1. Advantages

Use of this strategy would properly align the program to where it actually is in the acquisition cycle. As stated earlier in this study, the AAA Program Office has taken measures to mitigate risk and prove the concept of high-water speed armored vehicles prior to entry into Phase I of the acquisition cycle. These measures were in the form of Advanced Technology Demonstrators and Propulsion System Demonstrators and have proven the concept validity of high-water speeds. The early measures taken to prove this concept have left very little to accomplish in a traditional Phase I. However, the program requires engineering development to prepare it for production.

With concept demonstration and validation of the system essentially complete, there is little reason to dedicate resources and time to another evolution of DEMVAL. This time could be better spent in development of engineering and manufacturing processes for production of the vehicle. The technologies involved with producing a AAAV are mature and understood by industry. The difficulty is the integration of all requirements of the AAAV into one vehicle, which warrants time spent on development.

2. Disadvantages

The primary disadvantage of this approach derives from the requirement for a power-plant for this vehicle that must produce at least 2600 horsepower for the system to achieve high-water speeds. The engine must do so and remain in the confines of a predetermined amount of space for the engine compartment. The engine is currently under development and is considered the pacing item for producing the AAAV. Should problems arise in development of the engine, it is possible that the remainder of the vehicle could have been developed, relying on the 2600 horsepower engine, and the engine could not be produced. This could even necessitate the re-design of the vehicle itself to match a power-plant of different dimensions than previously anticipated. Heavy reliance on an undeveloped system component could put the overall program in jeopardy if the component cannot be produced.

3. Analysis

On the surface, this strategy appears risky because so much rides on development of the engine to power the AAAV. However, a significant amount of time could be saved in the acquisition cycle if this method were successful.

Since the engine is the pacing item for producing a successful full-scale AAAV, determination of whether to use this method should ride on the engine development. Currently, development of the 2600 horsepower engine is progressing on schedule with the expectations that it will be produced somewhere around October of 1994. [Ref. 41] The Milestone I review is scheduled for March of 1994, and it is assumed that at this review, permission would be obtained to commence Phase II activities in Phase I of the acquisition cycle.

Before this strategy is put in place, an in-process review with the contractor developing the engine should be held to determine the likelihood of his delivering the engine on time. If development is still progressing smoothly, then RFPs should be released to industry for production of a full-scale prototype and eventual production of the system. This would represent the down-selection to one contractor discussed earlier. By the time the full-scale prototype is delivered to the Government, the 2600 horsepower engine should have been produced, delivered to the Government and tested. At this point the power-plant could be integrated into the AAAV and further development could proceed.

F. SUMMARY

This chapter presented the advantages and disadvantages associated with each method recommended to shorten or accelerate the acquisition cycle for procurement of the AAAV for the Marine Corps. As with any acquisition program, there are risks involved for the procuring activity. The intent with the recommended methods is not to increase the level of risk to a point unacceptable for the Government. The Marine Corps is in a unique position to implement the recommended methods of acquisition acceleration. These advantages exist as a result of the AAA Program Office's early attempts at risk mitigation and in-house expertise with amphibious vehicles. This tailoring of the acquisition cycle for the AAAV procurement can proceed without significantly increasing the amount of risk to the program.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The focus of this research effort was to define the concept of *advanced* amphibious assault and how this concept has been realized by the AAAV. Additionally, this study focused on methods of accelerating the acquisition process for procurement of the AAAV and evaluated these methods against their application to the U.S. Marine Corps AAAV program. Based on this study, the following conclusions are made.

1. The concept of Advanced Amphibious Assault (AAA), to include operational maneuver from the sea, is a revolutionary advance in warfare.

The heart of the AAA concept is operational maneuver from the sea, which is the smooth transition of seaborne Marine Forces from the world's oceans to land areas. This concept, as supported by the Advanced Amphibious Assault Vehicle, essentially provides for maneuver warfare on the sea as well as on land. The AAA concept minimizes the ocean as a barrier or obstacle to American power projection through Naval Forces. Use of the AAA concept and world-wide dominance of the U. S. Navy provide a significant component of a credible forward presence for the United States as the American overseas basing structure continues to decline.

2. <u>The existing system used by the Marine Corps for amphibious operations is inadequate for support of the Advanced Amphibious Assault concept.</u>

Since 1972, the Marine Corps has relied on the AAV7/AAV7A1 family of amphibious vehicles to support their amphibious operations. The AAA concept emphasizes speed, mobility, and maneuver, on water and land. With a top water-speed of approximately eight miles per hour, the AAV7A1 is extremely limited in its ability to support any of the goals of AAA. Embarkation of the vehicles must occur within 4000 yards of the landing area due to various limiting factors of the current system. The time required to transit the distance from ship-to-shore limits the maneuver ability in the water to a straight-line, frontal attack of the area to be assaulted. Once ashore, the AAV7A1 does not possess the cross country speed for use as a land maneuver element with heavy armor or as an IFV.

3. <u>The AAAV procurement represents a program qualified for acceleration of the acquisition cycle based on urgency of need, program type and program risk.</u>

One of the most effective methods for accelerating the acquisition cycle for procurement of major weapon systems is through tailoring the acquisition process to match the system. Tailoring should only occur if certain conditions can be met relating to time requirements, program risk and program type. Since the current amphibious vehicle used for the surface-borne element of amphibious operations is inadequate for use with the AAA concept and is fast approaching the end of its service life (2004), the need to field a replacement system seems legitimate.

The requirements established for the AAAV do not push the edge of technology. Each element of the AAAV requirements package is readily achievable through existing or mature technology. While the AAAV does not represent a "non-developmental" program, the amount of development required is significantly less than that required for new or high technology development. The challenge to the program is integration of all requirements in one weapon system.

Closely related to program type is the risk associated with the program. AAA represents a program that has aggressively taken action to minimize risk in concept development for the AAAV. Prior to entering the Demonstration and Validation Phase of the acquisition cycle, the Marine Corps has validated the concept of high-water and land speeds in one vehicle through technology demonstrators.

4. <u>The traditional benefits of competition will not be realized with the procurement of the AAAV.</u>

Competition will most likely not benefit procurement of the AAAV. Economy of scale considerations will preclude the splitting of the production award between two defense contractors since only approximately 330 AAAVs are expected to be procured. The similarity in technical approaches of the two contractors also negates any real need for competition to take place, since whichever contractor is chosen will deliver a AAAV using a planing hull approach. Finally, the declining defense business base means contractors will be forced to be more competitive to survive in the environment of today. This will mean early, "best and final offers," and a tendency for contractors to better contain costs once contracts are awarded. Cost containment will take on even more significance in future Government contracts since there will be less defense business and contractors are likely to be more closely evaluated on their past performance, to include cost containment on Government contracts.

5. A strategy for accelerating procurement of a weapon system should be evaluated specifically by the effect it will have on the particular system acquisition.

Each weapon system procurement must be viewed as an unique evolution within acquisition. The concept of tailoring the acquisition cycle to "fit" specific system procurement indicates the importance of this premise. A strategy which has been successful in accelerating the procurement of a system in the past may not do so for a system different in program type. The concept of concurrent engineering is a good example of a method or process that can quickly produce a high-quality system in areas where mature technologies are involved, but one that may not be as appropriate for systems pushing the technological envelope.

B. RECOMMENDATIONS

1. <u>That the AAA Program Office tailor its acquisition strategy based on urgency of need, program type, and program risk.</u>

As articulated by the <u>Program Manager's Notebook</u> the extent to which an acquisition cycle can be tailored should be related to urgency of need, program type, and program risk. Chapter IV of this study argues that the AAAV is the type of program that warrants tailoring of the system based on those criterion.

2. <u>That the AAA Program Office adopt an evolutionary acquisition strategy for procurement of the AAAV.</u>

Evolutionary acquisition will benefit development and production of the AAAV in that core requirements will be established early in the acquisition cycle, and then become "frozen" for the remainder of the program. This strategy will recognize early-on that advances will occur in certain technologies used on components in the system. Those components can be designed with an eye toward upgrades after the system has been produced and fielded. This will limit costly changes to the vehicle and permit those advancing technologies to mature at someone else's expense prior to integration on the AAAV.

3. <u>That the Program Office down-select to one contractor for development and production of the AAAV, placing emphasis on use of the concurrent engineering concept.</u>

Shortly after the Milestone I review, the Marine Corps should down-select to one contractor for development and production of the AAAV. The traditional benefits of competitive prototyping and second sourcing appear to be nonexistent based on the unique characteristics of this program and the current defense environment. The use of concurrent engineering, with close Government and USMC involvement, require that one contractor be chosen early in the acquisition cycle. Early selection of one contractor will prevent the undue costs associated with multiple contractor relationships, risk of Government sponsored technology transfer and enhance the benefits associated with concurrent engineering.

4. <u>That the AAA Program Office obtain permission at the Milestone I review to engage in engineering and manufacturing development activities during the course of Phase I of the acquisition cycle.</u>

Chapters IV and V of this study referred to this strategy as "deletion of Phase II." While under this strategy, the program would move directly from Phase I to production or Phase III, there would be no actual deletion of the requirements inherent in the Engineering and Manufacturing Development Phase of the acquisition cycle. This strategy simply begins those requirements while the program is still in the Demonstration and Validation Phase of the cycle. This is possible due to the early efforts taken by the AAA Program

Office to mitigate risk and prove the validity of the AAAV concept. In essence, most of the goals of Phase I have been accomplished for the AAAV prior to a Milestone I decision.

C. ANSWERS TO RESEARCH QUESTIONS

1. What are the viable methods and associated risks of accelerating the procurement process for the Advanced Amphibious Assault Vehicle (AAAV)?

An evolutionary acquisition strategy and down-selection to one contractor made shortly after the Milestone I review represent two methods for accelerating the acquisition process for the AAAV. Further acceleration can be achieved by use of concurrent engineering, making available to the contractor the corporate knowledge resident within the Marine Corps and Naval Surface Warfare Center (Carderock Division).

The risks associated with acceleration of the acquisition process for the AAAV are primarily related to cost overruns, schedule delays, and overall risk to the program.

2. What is the concept of AAA as it relates to the current roles and missions of the United States Marine Corps and how is it manifested by the Advanced Amphibious Assault Vehicle?

The concept of Advanced Amphibious Assault (AAA) is detailed in Chapter III of this study. In summary, AAA is the smooth transition from the sea to shore in armored vehicles. It is the ability to maneuver on the sea as well as on land from distances over the horizon, which will provide doubt as to the area to be assaulted. AAA, in concert with a strong Navy, provides a credible method for the projection of American military power in accordance with its post-cold war security doctrine.

3. <u>What are the critical criteria against which the methods of accelerating acquisition should be evaluated?</u>

Specific risks associated with each acceleration method were identified, focusing on factors that might increase the costs to the program in development or production of the system. Also, specific risks appropriate to acceleration methods were noted by questioning the effect of these methods on the acquisition schedule for the AAAV. Finally, any factor that might put the AAA Program at risk in general was used as test for each acceleration method.

4. <u>What types of risks are associated with each acceleration method that has been presented?</u>

In Chapter V, the selected methods for accelerating the acquisition cycle for procurement of the AAAV are evaluated as to the risks they might bring to the program. The specific risks to each acceleration method vary since the acceleration methods themselves differ. A discussion of the advantages and disadvantages relevant to each acceleration method is also provided. These discussions will help to better determine whether the strategies are potentially viable for use with procurement of the AAAV.

5. <u>What is the recommended strategy for procurement of a new Advanced Amphibious Assault Vehicle for the United States Marine Corps?</u>

The recommended strategy for procurement of the Advanced Amphibious Assault Vehicle is based on an evolutionary acquisition strategy. Next, down-selection to one contractor for development and production of the system is recommended so that Government and industry can work closely together in a non-adversarial relationship making judicious use of the concurrent engineering concept. Finally, the deletion of Phase II of the acquisition cycle, or more properly, the accomplishment of Phase II requirements during Phase I of the process for the AAAV is recommended.

These recommendations are provided as specifically applicable to the AAA Program. They are made due to the unique posture of the AAA Program based on early attempts at risk reduction, use of mature technologies, and excellent in-house amphibious vehicle expertise.

D. AREAS FOR FURTHER RESEARCH

Earlier studies have lauded the influence competition can have on the acquisition of major weapon systems. However, other research has suggested that continued competition or second sourcing may not be as beneficial to lower prices for the Government as earlier believed. The Center for Naval Analysis observed that Winner-Take-All Awards increase the projected cost savings of the contract by deriving a lower price for the system. The premise for this finding was discussed in Chapters IV and V of this study.

The researcher believes there is some truth to both assertions. Future research in this area could attempt to determine the type of system or environment that would be conducive to competition carried through most phases of the acquisition cycle. The study could focus on the size of the buy, the numbers of systems to be procured or the defense environment, specifically defense spending, at the time. Comparison could be made between systems that used competition, those that did not, large number buys, small number buys, procurement during the defense buildup of the early 1980s, and procurement in an era of declining expenditures. Research in this area could provide a framework or tailoring mechanism for the type of competition strategy recommended for each system based on its inherent characteristics and the environment in which it is to be procured.

An area that could be beneficial to the Marine Corps once the AAAV is fielded would be a study to determine the best way to provide system maintenance and logistics support. Currently Marine Corps units that hold the existing amphibious vehicle, the AAV7A1, possess an in-house capability to conduct up to fourth echelon maintenance and maintain their own repair parts organic to the battalion level unit. The AAAV is a vehicle that promises to be more complex and expensive to maintain than the current system. A study could be conducted to determine how to best plan for support of the AAAV when fielded to Marine Corps units. Comparisons between an architecture similar to the one now in place for support and a method whereby most maintenance would be accomplished by a depot could be made to determine the most cost-effective alternative for the Marine Corps to implement.

APPENDIX A

LIST OF ABBREVIATIONS

AAV	Amphibious Assault Vehicle
AAA	Advanced Amphibious Assault
AAAV	Advanced Amphibious Assault Vehicle
ACAT	Acquisition Category
ADM	Acquisition Decision Memorandum
APC	Armored Personnel Carrier
ATD	Advanced Technology Demonstrator
ATR	Automotive Test Rig
CAD	Computer Aided Design
CAE	Computer Aided Engineering
CAM	Computer Aided Manufacturing
CE	Concept Exploration
CICA	Competition in Contracting Act
CNA	Center for Naval Analysis
COEA	Cost and Operational Effectiveness Analysis
DAB	Defense Acquisition Board
DEMVAL	Demonstration and Validation
DFARS	Defense Federal Acquisition Regulation Supplement
DLSIE	Defense Logistics Studies Information Exchange
DOD	Department of Defense
DRB	Defense Resources Board
DT&E	Development Test and Evaluation

ECP	Engineering Change Proposal
EMD	Engineering and Manufacturing Development
ICE	Independent Cost Estimate
IFV	Infantry Fighting Vehicle
JROC	Joint Requirements Oversight Council
LCAC	Landing Craft Air Cushion
LCVP	Landing Craft, Vehicles and Personnel
LRIP	Low Rate Initial Production
LVT	Landing Vehicle Tracked
MAGTF	Marine Air Ground Task Force
MCCDC	Marine Corps Combat Development Command
MDA	Milestone Decision Authority
MNS	Mission Need Statement
MTR	Military Technical Revolution
OMFTS	Operational Maneuver From The Sea
OT&E	Operational Test and Evaluation
OTH	Over-The-Horizon
OSD	Office of Secretary of Defense
PDM	Program Decision Memorandum
PERT	Program Evaluation Review Technique
POM	Program Objective Memorandum
PPBS	Planning, Programming, and Budgeting System
PSD	Propulsion System Demonstrator
RFP	Request For Proposal
SLEP	Service Life Extension Program

APPENDIX B

ADVANCED AMPHIBIOUS ASSAULT

ALTERNATIVE SYSTEMS

CATEGORY I (HIGH SPEED AMPHIBIANS)

-AAAV(F) (Newly designed vehicle)

-AAV7A2(F) (Reconfiguration of current vehicle for high water speed)

CATEGORY II (SLOW SPEED AMPHIBIANS)

-AAAV(S) (Newly designed slow-speed amphibian)

-AAV7A1 (Current system)

-AAV7A2(S) (Current system dramatically improved through second SLEP)

-SUBMERSIBLE (Tracked underwater vehicle)

CATEGORY III (NONAMPHIBIANS)

-APC(X) (Newly designed armored personnel carrier)

-LAV-25 (Wheeled vehicle currently in Marine Corps inventory)

-M113A3

-M2A2 BRADLEY FIGHTING VEHICLE (Currently in U.S. Army inventory)

-FIFV (U.S. Army ASM program) (Required for commonality analysis)

CATEGORY IV (NONVEHICLES)

-SURFACE OPTION (Infantry brought to shore in shelters mounted on LCAC)

-AIR OPTION (All infantry is carried ashore in helicopters)

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